Cement MILL EDITION of

Concrete

Devoted to the Manufacture
of Portland Cement

MARCH, 1934

400 West Madison Street
Chicago, Illinois

AND
OMPTLY
R
T TO b.

REF'D
RECEIVED
MAR 3 - 1934
ANS'D
BY
DATE
FOR INFO
FOR REPLY

LEAVING THE JOB TO UNCLE SAM

◆

AFTER taking it on the chin for four years, the construction industry has made a heroic start toward recuperation.

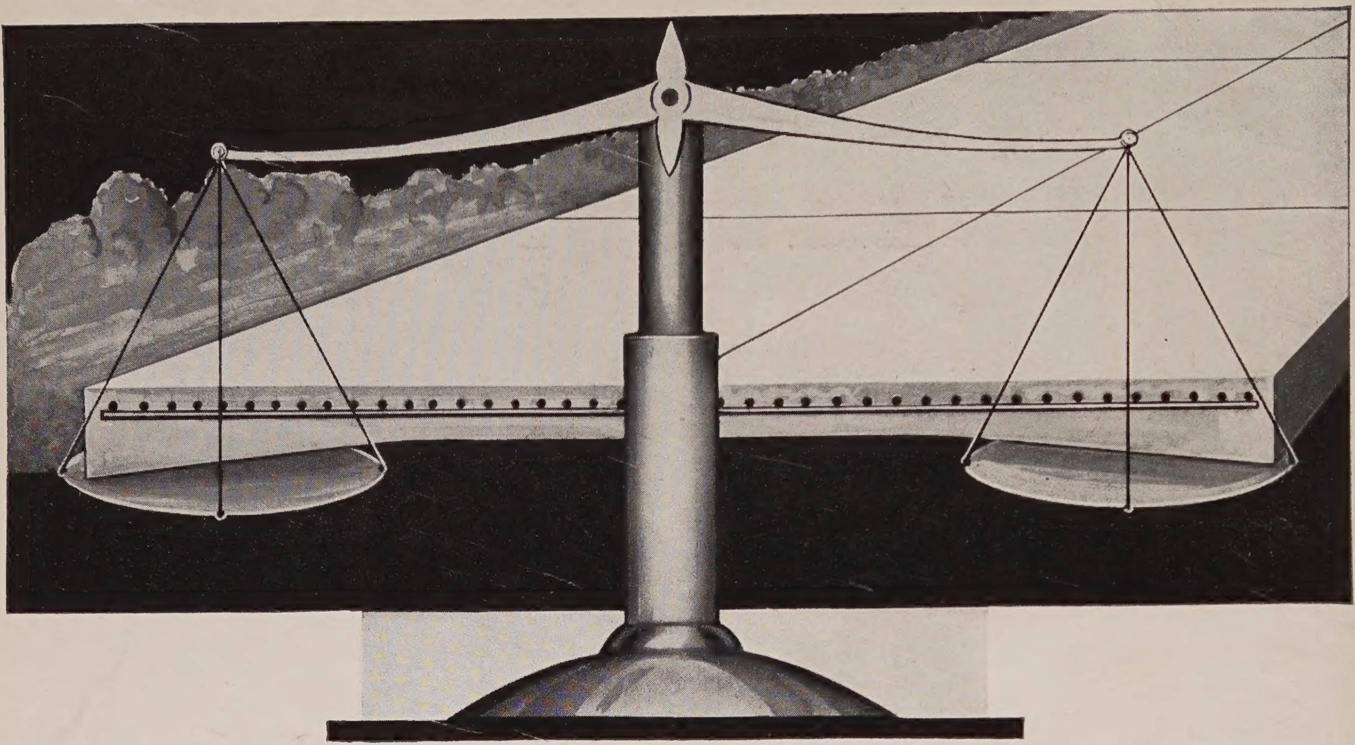
❡ It is most unfortunate that one of the greatest obstructions encountered by this industry arises from the loss of highway construction funds that have been diverted to other uses.

❡ For this situation we have our state governors and state legislators to thank. Faced with difficulties that required the wisdom and courage of statesmen for their solution, they have solved them as politicians solve their problems—the easiest way.

❡ Now, since the federal government came to the rescue with funds that require no matching by states, some of our state officials are making little effort toward getting the undiverted highway funds into circulation. Here, again, they are taking the easiest way by leaving it all to Uncle Sam.

❡ A terrific fight will be required to prevent further diversion of present road fund receipts, and further mortgaging of future receipts, and to spur our state and county governments into action with the undiverted funds at their disposal.

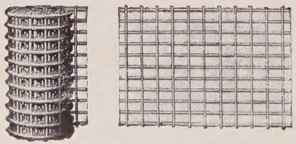
IN ROAD CONSTRUCTION



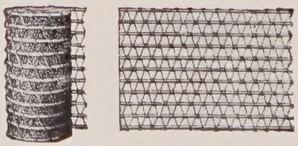
a balanced design is essential

A BALANCED design reduces future maintenance costs and can only be provided when all parts of the concrete slab or concrete base course develop the same unit stress produced from a constant applied wheel load. Cracks from various causes are liable to form in pavements in spite of predetermined expansion and contraction joints. American Steel & Wire Company Welded Wire Fabric ties these un-predetermined cracks together and maintains a balanced design by assuring genuine load transference across the cracks. Our booklet Reinforced Roads and Streets explains in detail why it is essential to properly balance the pavement design. Your copy will be forwarded upon request.

FURNISHED IN ROLLS OR SHEETS



Electric Weld



Triangle Mesh

1831 MORE THAN 100 YEARS OF PROGRESS IN WIRE MAKING 1934

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago
94 Grove Street, Worcester

SUBSIDIARY OF UNITED STATES STEEL CORPORATION
AND ALL PRINCIPAL CITIES

Empire State Bldg., New York
First National Bank Bldg., Baltimore

Pacific Coast Distributors: Columbia Steel Company, Russ Building, San Francisco
Export Distributors: United States Steel Products Company, New York

Cement Mill Edition of CONCRETE, March, 1934. Vol. 42, No. 3. $4.00 per year, 50c per copy. Entered as second-class matter, August 14, 1925, at the postoffice at Chicago, Ill., under Act of March 3, 1879. Published monthly by Concrete Publishing Company, Chicago, Ill.

Vol. XLII, No. 3 Concrete March, 1934

High-Early-Strength Cement Speeds Elevated Highway Construction

Reinforced Concrete Structure 1,800 Ft. Long Completes 40-Mile Super-Highway in New Jersey Metropolitan Area —Work Is 40 Days Ahead of Schedule

THE use of high-early-strength cement for a portion of the concrete in an 1,800-ft. 38-span viaduct under construction through Newark, N. J., on State Highway Route 29, will shorten the time originally set for the structure's completion a full 40 days, it is estimated. Started in April, 1933, the work at the year's end was a month ahead of schedule.

Closes a 40-Mile Link

This viaduct is the last link to be built in what will be one of the principal highways across the state. When completed it will permit of the free movement of traffic from Jersey City to Somerville, a distance of 40 miles. The highway either by-passes all intervening important centers or passes over or under their streets.

The project is located in the southwestern section of Newark. It crosses over two streets, and over the tracks of the Pennsylvania and Lehigh Valley Railroads.

One of the streets crossed is Frelinghuysen Avenue, one of the widest streets in Newark, as well as one of the most heavily traveled. This cross-over is located in about the middle of the project. The other street intersected is Empire Street, near the west end. The Pennsylvania Railroad crossing is at the east end, and that of the Lehigh Valley about midway between Frelinghuysen Avenue and the west end.

Twenty-nine Spans of Reinforced Concrete

The structure is built of reinforced concrete except at the intersections of the two streets and the tracks of the Pennsylvania Railroad. At these points the deck is carried by steel beams encased in concrete (partly gunite). Altogether there are nine steel spans—one at Empire Street (62 ft.); four at Frelinghuysen Avenue (67 to 92 ft.); and four at the Pennsylvania Railroad crossing (84 ft. average).

There are 29 reinforced concrete spans, of which 25 average 42 ft., and the balance 25 ft. The structure carries a 40-ft. roadway and two footpaths each 2 ft. 9 in. wide.

The floor slab is 10 in. thick. Concrete girders are 6 ft. deep at the supports and 4 ft. in the middle of spans. The concrete section is supported by five-column bents, and the steel section by three-column bents. Column sizes are 26 by 36 in. and 36 by 42 in., respectively.

Two ramps provide access to the viaduct from the east side of Frelinghuysen Avenue. These approaches are 378 ft. long, with 18 ft. 8 in. roadways, and footpaths.

The contractor's bid price for the job was $425,000, and the principal items involved are as follows:

Class A Concrete	7,105 lin. ft.
Class B Concrete	8,591 cu. yds.
Class C Concrete	3,682 cu. yds.
Reinforcing Steel	2,031,895 lbs.
Structural Steel	1,777,050 lbs.
Bituminous Concrete Pavings	8,500 sq. yds.

Class A concrete (mix 1:1.5:3) was specified for the balustrades; Class B concrete (mix 1:1.61:3.5) for the superstructure, excepting balustrades; and Class C concrete (mix 1:1.64:4.0) for the foundations.

Drive Concrete Piles 5 Days After Casting

Included also in the work were 500 concrete piles (Class A concrete), from 30 to 60 ft. long. These were made, on a sub-contract basis, by the Massey Concrete Products Company.

Eighty per cent of the piles were made with high-early-strength cement. These were driven five days after casting, with a 7-ton double-acting hammer. They were driven to a final penetration of 1/3 in. per blow. Piles made with ordinary cement were held 30 days before driving.

Elevated state highway structure crossing Frelinghuysen Avenue, Newark, N. J.

It was an advantage to be able to drive the high-early-strength piles 25 days ahead of time, thus paving the way that much earlier for subsequent operations. Of equal importance in these days of widespread unemployment, it enabled the contractor the sooner to increase his working force to a maximum.

However, the principal reason for the use of this type of pile was the saving in forms that could be effected. Forms were stripped from the high-early-strength piles the next morning after casting. They were kept on the ordinary cement piles for three days. In order that no additional forms would be required, the ordinary cement piles were made only on Friday, the last day of the construction week. This schedule permitted the piles to be stripped and the forms re-used the following Monday, which was the next working day. Had all the piles been made with ordinary cement, more than double the number of forms would have been required to maintain the same rate of production.

High-Early-Strength Cement in Girders and Deck

High-early-strength cement was also used in certain portions of the deck and supporting girders. Its use was decided upon as an after-consideration and for the purpose of speeding up the work. (The stripping requirement for high-early-strength concrete is 4 days, as compared to 14 days for regular concrete.) At the time, nine sections of the deck and supporting girders remained to be concreted. Three of these sections were at the west end and six at the east end. Not much more than a complete set of forms was available at either end.

It was at first decided to speed up only the six east-end sections, with the idea that they would be completed in about the same time as the three west-end sections prosecuted at normal speed.

Two plans were considered. One was to provide the extra lumber and frame the entire six east-end sections, concreting each as completed with ordinary cement concrete. The cost of the additional lumber was estimtaed at approximately $12,000.

Rapid-Hardening Cement Saves Form Lumber

The second plan was to use high-early-strength cement for five of the six east-end sections. It was estimated that by so doing, 40 days would be saved on account of the difference in stripping requirements. Also, by using high-early-strength cement for two of the three west-end sections, the single set of forms at that end would be released in time to re-use it in the sixth section at the east-end. This, then, being the last section, could be completed with regular concrete.

Another advantage of this plan was that the equipment and organization at the west-end, in addition to the set of forms, would be the sooner released for transfer to the east-end, thus further contributing to the speed of completion at that end.

The only additional item of expense in this second plan was $2,500 for the extra cost of the high-early-strength cement. This being but 21 per cent of the additional cost of Plan No. 1—and the time saving being as stated, 40 days—Plan No. 2 was adopted.

Place Superstructure Concrete from Towers

All concrete was mixed on the job except for the balustrades. Two pavers were used for the purpose. Superstructure concrete was placed from two steel towers, 57 and 59 ft. high, respectively, mounted on pavers. One of these outfits was operated on either side of the structure. This arrangement proved a big time saver on the job. The maximum day's output with both mixers working occurred on October 23, when 535 cu. yd. of Class B concrete were placed in 10 hours.

For the balustrades, pre-mixed concrete was used, obtained from a nearby commercial plant. This concrete was trucked over the completed deck and discharged directly into the forms.

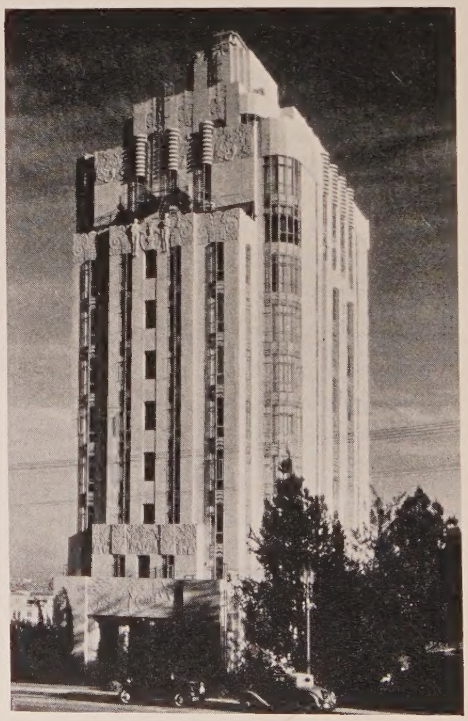
An excellent finish was obtained on all exposed concrete surfaces. This was obtained by rubbing the concrete with carborundum wet with water. Both fine and coarse textures of carborundum were used. The result is very striking.

During the greater part of the construction period about 160 men were continuously employed on this project.

Acknowledgment: The P. T. Cox Contracting Company, New York, has the contract for the viaduct. It is a New Jersey State Highway project, and is officially designated as Route 29, Section 10-B. Construction operations, as stated, got under way in April, last year, and the work is expected to be completed in April of this year.

Concrete in Architecture

THE use of concrete for the double purpose of providing structural strength and architectural expressions is rarely demonstrated in more striking form than in the Sunset Towers apartment, Los Angeles, California.


Sunset Towers Apartment, Los Angeles California

The entire exterior is of monolithic concrete, all decorative work having been cast in place.

This modern example of plastic architecture was designed by Leland Bryant, a Los Angeles architect.

Concrete Slabs and Precast Joists Act as Monolithic T-Beams

Tests Disclose Large Factor of Safety in Bond Strength Between Slab and Joist—Loading to Failure Caused No Failure in Bond

By F. N. MENEFEE
Professor of Engineering Mechanics, University of Michigan, Ann Arbor, Michigan

FIREPROOF construction and substitutes for wood in home building have received more than the usual amount of attention in the last few years. To those in the building industry who object to the rising costs of wood construction, along with the evils of shrinkage, decay and danger from fire, the results of studies in this field are always interesting.

Generally speaking, the results of a new idea, even when sound, have to be subjected to thorough test and trial. A case in point is the precast reinforced concrete floor joist and the attendant attempt to set it in place and cast a floor slab on top of it with the expectancy of obtaining T-beam action. To begin with, although not new, the precast concrete joist is still somewhat of a shock to the conservative; and yet there are some objections to the monolithic type of construction that the precast beam may avoid.

Joists Prove Value in Actual Service

Regardless of one's ideas as to what is orthodox, the precast beam is being made, cured, and delivered to the job, where it is functioning in accord with accepted principles of mechanics and where monolithic construction would be too expensive due to the cost of forms.

The quantitative shrinkage values of concrete are known; but quantitative values of the grip or the resistance to longitudinal shear of a thin, reinforced floor slab resting on and extending downward for a short distance on each side of the joist, were not known. The following is a résumé of the results of some tests made by the writer to solve the question.

The question resolves itself into one of the resistance to longitudinal movement of the slab relative to the joist. Without a complete bond between the beam and slab, T-beam action would not take place and the benefit of such action would be lost. To determine the efficacy of such construction, joists were set up on representative spans and spacing. Slabs were placed over them and later loaded.

Tests Confirm T-Beam Action

Several floor slab tests were made, some by the writer, others by the building inspectors in Kalamazoo and Grand Rapids, Michigan, and one by H. C. Berry, of the University of Pennsylvania.

Since the tests of the T-beam construction gave load deflection diagrams characteristic of concrete beams and since the loads indicated stresses in steel and concrete in conformity with values to be expected, it seemed reasonable to assume that the laws governing longitudinal shear should apply as well.

Referring to the concrete T-beam shown in Figure 1a, transverse loading of the beam would produce a longitudinal shear across AB and bond stress around ACDB.

The diagram showing variation in shear can be arrived at by the standard mechanics formula for shear stress, but in the case of the concrete beam it is simple to proceed as follows: By summation of horizontal forces, Figure 1b,

$$vbx = T_2 - T_1 \quad . \; . \; . \; . \; . \; . \; . \; . \; . \quad (1)$$

v being intensity of longitudinal shear, b the breadth, and x the length of the longitudinal portion of the beam under consideration. By summation of moments,

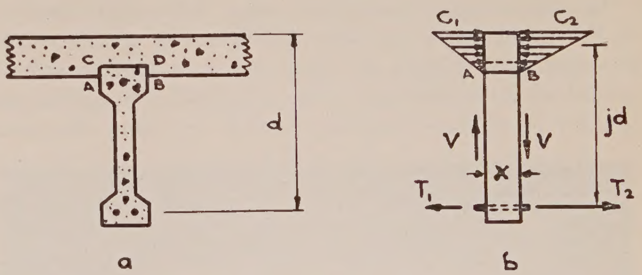


Figure 1. Precast joist, with slab, tested as a T-beam

$$Vx = (T_2 - T_1)\, jd = vbxjd$$

$$v = \frac{Vx}{bxjd} = \frac{V}{bjd} \quad . \; . \; . \; . \; . \; . \; . \; . \; . \; . \quad (2)$$

Taking for illustration the value of load per joist as 7,740 lb., width of joist as 3 in. and depth 10½ in., and assuming the neutral axis to be at or near the junction of the slab and joist we get,

$$v = \frac{3{,}870}{3 \times 10\frac{1}{2}} = 123 \text{ lb. per sq. in.}$$

as the intensity of longitudinal shear across AB, Figure 1a. The stress in the joint ACDB will be less than 123 lb. per sq. in., by the ratio of AB to ACDB, or 82 lb. per sq. in. Had the joist been imbedded only ½ in. the latter value would be 92.3 lb. per sq. in.

These values represent the shear at maximum load. The rated total load per beam was 3,400 lb.; hence the bond stress in the joint ACBD at the rated load was $\frac{1{,}700}{3{,}870} \times 82 = 36$ lb. per sq. in., for an imbedment of ¾ in., or $\frac{1{,}700}{3{,}870} \times 92.3 = 40.5$ lb. per sq. in., for an imbedment of ½ in.

In a test for the building inspector of Kalamazoo a panel supported by two beams on a 13 ft. 2 in. span, failed at 20,200 lb. of total load. The total shear at each beam end was 5,050 lb. The maximum unit shear across AB for $jd = 10\frac{1}{2}$ in. was 144 lb. per sq. in., and the probable stress on bond around ACDB (assuming imbedment of ¾ in.) was 96 lb. per sq. in.

The rated working load was 8,400 lb. as compared with 20,200 lb. at failure; hence the bond stress at the rated working load was $\frac{8{,}400}{20{,}200} \times 96 = 39.8$ lb. per sq. in.

No Failure in Bond

These two beams are typical of several that have been tested. The computed bond stress at the rated working load was about 40 lb. per sq. in.; that at failure between 90 and 100 lb. per sq. in., although the failure was never one of the bond between the slab and joist.

Variation of the value of jd in the formula for shear will seldom be more than 10 per cent, so that the above values seem to be about what may be expected in this type of construction on spans up to 20 ft.

Large Factor of Safety

In order to get a quantitative value of the bond strength of this molded mortise joint, ACDB, a test specimen was designed (see Figure 2) upon which a load could be placed which would have to be supported through the resistance of the bond between the slab and joist. The slab portion was reinforced in both directions with two 5/16-in. rods. In some cases the tie rods running from one slab to the other were looped, and in other cases the loops were omitted.

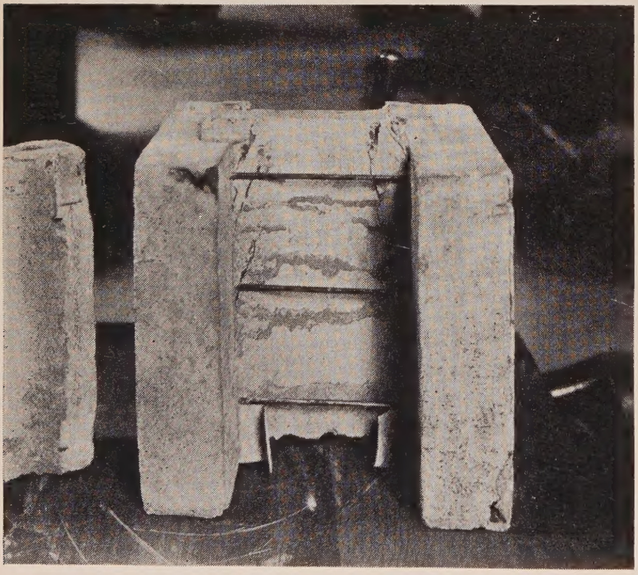


Figure 2. Type of specimens used for testing bond strength at failure

Column 5 of Table 1 shows the resistance, in lb. per sq. in., of each of 14 separate specimens made up for the first test. It will be noted that the lowest value is 269 lb. per sq. in., whereas the computed value of maximum bond stress around ACDB in full sized floor panels was about 100 lb. per sq. in. and the bond stress at working loads was about 40 lb. per sq. in. The factor of safety is greater than that which we demand in concrete work. At later dates, other batches were made up and tested. The results are shown in Tables 2, 3 and 4. The values check closely those of Table 1.

TABLE 1, JANUARY, 1932

Specimen	Age, days	Mix	Cement	Bond resistance at failure, lb. per. sq. in.	Comp. str., lb. per sq. in.
1	16	1:2:3	A	432	
2	13		A	528	
3	28	1:2:4	A	482	1,860
4	28		A	312	1,990
5	28	1:2:4	B	460	1,990
6	28		B	535	1,700
			B		1,770
7[1]	34	1:2½:3	C	606	3,270
8	34		C	547	
9	58		C	650	3,060
10	58			587	
11[2]	38	1:2:4	D	346	685
12	38			269	730
13	38			305	
14[3]	38			350	

[1] This specimen did not fail in bond but by shearing of the pre-cast joist.

[2] 2 lb. calcium chloride per sack of cement.

[3] 4-in. silo tile replacing Lith-I-Bar pre-cast joist.

TABLE 2, JANUARY, 1933

Specimen	Age, days	Mix	Bond resistance at failure, lb. per sq. in.	Comp str., lb. per sq. in.
1	21	1:1.5:4	360	2,175
2	31	"	327	2,330
3	31	"	310	2,450
4	31	"	180	1,600
5	31	"	295	2,170
6	31	"	301	2,110

TABLE 3, FEBRUARY, 1933

1	31	1:2:4	276	2,700
2	31	"	196	
3	31	"	562	4,310
4	31	"	522	3,790
5	31	"	338	2,870
6	31	"	355	3,410

TABLE 4, MARCH, 1933

1	28	1:2:3	530	2,875
2	28	"	501	
3	28	1:2.15:2.85	450	
4	28	"	210	
5	28	"	200	
6	28	"	130	

Additional Tests Contemplated

Because of the surprising results and at the suggestion of H. F. Young, of Kalamazoo, we made up four specimens in which the mortise joint was omitted entirely, the precast joist being cemented to the slabs with a mortar made of 3 lb. cement, 6 lb. sand, 0.43 lb. lime and 1.55 lb. water. Table 5 shows the results.

TABLE 5, MAY, 1933

Specimen	Mix	Cement	Bond resistance at failure, lb. per sq. in.
1	3 lb. sand	A	99
2	6 lb. cement	A	122
3	0.43 lb. lime	B	230
4	1.55 lb. water	B	216

The writer hopes to carry on more tests on larger size webs and greater thicknesses of slab, but for floor slabs and precast joists of dimensions referred to in the foregoing it is safe to say that with a mortise ¾ in. deep, and with concrete that will readily flow around the joist, failure will come somewhere else than in the bond at the junction between slab and joist.

Plywood Form Material on Complicated Two-Story Building

All Form Materials Cut to Size at Material Yard, in Accordance with Shop Drawings

AN average of 3½ uses was obtained from the plywood employed for the concrete form work on a large reinforced concrete industrial building now approaching completion—a 2-story building with rather complicated construction in the roof, including the complications due to the reinforced concrete saw-tooth details.

The building is being erected in the Central Manufacturing District in Chicago, at 42nd Street and Crawford Avenue, for the Chicago Carton Company. Its construction involves the placing of 14,000 cu. yd. of structural concrete, all of which has been completed. The work required 95,000 sq. ft. of plywood, for a total contact form area of about 350,000 sq. ft.

New concrete industrial building for the Chicago Carton Co. Observe the reinforced concrete saw-tooth roof construction

Shop Drawings for Concrete Form Work

A notable feature of this construction project is the manner in which all concrete forms were cut to size in the material yard in accordance with fully detailed shop drawings. The plywood used was 5-ply Douglas fir material, sanded on both sides and having a finished thickness of 9/16 in. Plywood of this thickness, of course, has more than the necessary structural strength to serve as sheathing, so that the only other form lumber required was the material needed for studs and joists.

Form Units Marked

The plywood sheets were all cut to the proper size and given their identification numbers at the material yard, in accordance with the shop details. In consequence, when the form material was delivered to the construction job the units were sorted in a systematic manner and job labor was used effectively.

While many different sizes and shapes of form units were required, about 2,000 pieces of plywood of the 40 by 96-in. size were used. Thus about 50,000 sq. ft. of form material totaling 95,000 sq. ft. consisted of this one size—an accomplishment that was possible on a building of this character only because the form work was carefully detailed in advance.

Because of the use of the plywood forms, the concrete work has an excellent appearance. The surfaces are smooth, the corners and edges are clean cut, and the beams and long girders are in true alignment.

Distribution of Concrete

As the illustration indicates, the concrete was distributed by means of a hoisting tower and a chute, and from the hopper into which the chute discharged, the final distribution was made by buggies operating on runways built at a level above the peaks of the saw-tooth roof construction.

The concrete mixing equipment consisted of two ¾-yd. mixers. The hoisting bucket had a capacity of 1¼ cu. yd., and was operated by a 90-hp. gasoline-driven hoist.

Crushed stone and torpedo sand were used as aggregates. The proportions employed were 1:1:2 for the column concrete, and 1:2:4 throughout the floor and roof construction.

Precast reinforced concrete roofing slabs, in which haydite was used as the aggregate, were placed over the large machine shop at the north end of the building.

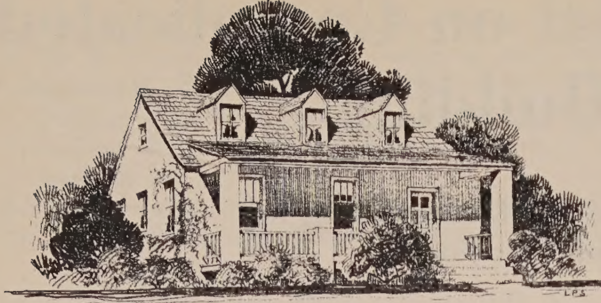
Acknowledgments: The Douglas fir plywood used on this contract is sold under the trade name of "plycrete" and is manufactured by the Harbor Plywood Corporation, of Chicago, at the company's plant at Hoquiam, Washington. The Federal-American Cement Tile Company manufactured the precast concrete roofing slabs. The building was designed by A. Epstein, structural engineer, and the formwork details were prepared by the Bosco Form Service, of Chicago. The general contractor is the Poirot Construction Company, also of Chicago.

Favorable Building Outlook for 1934

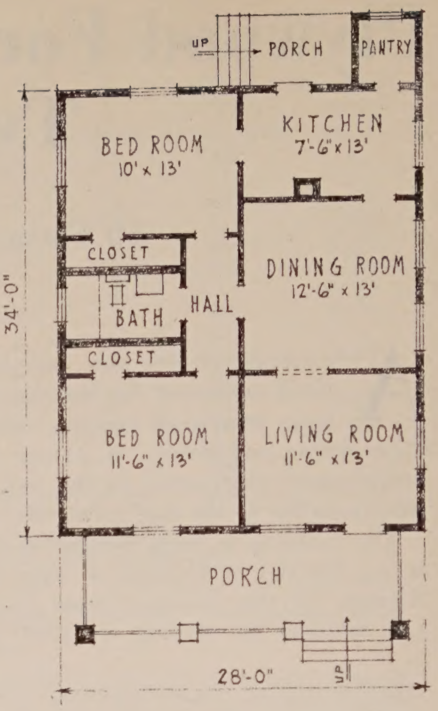
THE biggest obstacle to sustained building revival still appears to be the difficulty in obtaining adequate financing, according to the Brookmire report of February 26. The best prospects for building recovery still exist in the residential field, though industrial building has shown surprising vitality.

In summarizing, they report that general business is definitely in the expansion period and consumers' incomes are rising. The financial situation has been strengthened greatly, and monetary uncertainties are being removed.

The biggest gains in building in 1934 will be in publicly financed engineering construction; but privately financed types will also register appreciable gains, they believe—particularly small residences. Total construction for 1934 will register a substantial increase over 1933.



Perspective drawing of concrete masonry residence for J. H. Stewart, Cold Harbor, Virginia, with plan—built at a cost of $2,100



Victims of Fire Best Prospects for Firesafe Homes

Richmond Products Manufacturer Shows Owners the Secret of Low-Cost Home Construction — Economical Fireproof Partitions—Co-operating with Contractors

ANY man whose house has just burned down is the best of all possible prospects for a firesafe concrete home.

On this common-sense assumption, Edmund A. Smith, sales manager of the Cinder Block Corporation, of Richmond, Va., watches the reports of fires in his territory and calls in person on the victims of those fires.

Fire Victims Willing to Listen

And, often enough to justify his strategy, he finds the prospect more than willing to get down to cases on the matter of firesafe construction.

Many fire victims are unable to finance immediate reconstruction. This has been particularly true of farmers during recent years. In numerous instances the fire insurance realized from the destruction of a house was so small that the owner had no hope it would cover the building of any kind of house, particularly a firesafe house.

Within the Insurance Money

In at least two cases, within the last year, owners obtained considerably less than $2,000 from fire insurance; in one case the amount was $1,200 and in the other about $1,600. To both men, sales manager Smith made this proposition.

"You've got to have a new house of some sort. There are plenty of contractors who'll throw together a little wood frame bungalow for you, cheap. But it'll burn, and you don't want any more fires, at any price. If I show you how you can build a concrete masonry house, firesafe and livable, for no more than a burnable house would cost, would you be interested? If I show you how you can build such a house for the amount of your insurance, how about that?"

Obviously, they were interested. Smith drew up rough floor plans, got in touch with a couple of contractors who, in turn, submitted bids to the prospects. It wasn't long before the Cinder Block Corporation got its orders.

Cost Figures Surprisingly Low

The unusual possibilities open to products manufacturers and to concrete contractors may be realized from the ample size and low cost of one of the concrete houses promoted by Smith—a residence for J. H. Stewart, of Cold Harbor, Virginia, shown in the plan and perspective here illustrated. The cubical content of the building is as follows:

	Cu. ft.
Main portion, 28 by 34 by 17.5 ft.	16,660
Pantry, 5.5 by 5.5 by 11 ft.	335
Porch, (half of actual cubage)	1,430
Service porch (half of actual cubage)	245
Steps, front and rear	125
Dormers	170
Chimney	15
Total	18,980

The claim of low cost is shown in most surprising fashion from the following figures, reported by Mr. Smith:

Cinder, blocks, walls and partitions	$ 351.59
Cement, sand, gravel, plaster, etc.	180.00
Rough lumber, millwork, flooring, glazing and roofing	500.00
Hardware and flashing	50.00
Electric wiring	30.00
Masonry labor, including excavation	150.00
Plastering and stucco labor	100.00
Carpentry labor	200.00
Plumbing (estimated)	200.00
Heating (estimated)	300.00
Electrical fixtures (estimated)	30.00
Completed cost	$2,091.59

Livable and comfortably small houses of concrete masonry are beginning to appear all over the country—not only in the Richmond territory but wherever enterprising products men demonstrate that it costs no more to build with firesafe materials. Incidentally, a fact repeatedly demonstrated by Smith is that partition walls built up of 3-in. cinder blocks, plastered on each face, are definitely less expensive than ordinary stud partitions, with lath and plaster.

Toronto Convention Sees Highlights of Progress in Concrete

American Concrete Institute's 30th Annual Convention Has Well Balanced Program — Architectural Concrete Given Prominence—Earley and Mercer Win Medals

WITH a registration approximating 300, and a program crowded with discussions of the foremost developments in cement and concrete construction, the American Concrete Institute's 30th annual convention at Toronto, held on February 20, 21 and 22, has passed into history.

A satisfying feature of this convention was the fact that the well balanced program was not overcrowded. In practically all of the six sessions some time was available for discussions from the floor. The delegates accepted the privilege.

Joint Session with Products Associations

The first session was held in conjunction with the National Concrete Masonry Association and with the Concrete Products Association of Canada. Papers in this session included an interesting discussion of the new building code for Toronto, now approaching completion, with particular reference to the chapters dealing with concrete and structural design, for which the requirements are being modernized. This paper was presented by J. Morrow Oxley, of Chapman & Oxley, architects, Toronto.

"Some Tests of Load Capacity of Floors of Precast Concrete Joist Construction" was the subject of a paper by R. E. Copeland, of the Portland Cement Association. The tests under discussion prove conclusively that a complete bond exists between the precast reinforced concrete joist and the overlying cast-in-place reinforced concrete slab, thereby causing T-beam action in the combination. This result is in agreement with the University of Michigan tests described by F. N. Menefee in this issue of CONCRETE.

E. Viens, director of the testing laboratories of the Department of Public Works at Ottawa, read an illustrated paper on the subject "Does Cement Protect a Poor Quality Aggregate?" The evidence presented clearly shows the need for sound aggregates in concrete work exposed to extreme weather conditions.

"Durability Studies of Concrete and Aggregates," by Inge Lyse and J. M. Holme, of Lehigh University, was presented by Professor Lyse. The authors conclude that durability is an economic problem which can be obtained by the use of a high-grade aggregate in paste of good quality, or by aggregate of lower grade in paste of high quality, or by the use of low-quality paste with long curing or high-quality paste with a short period of curing.

Architectural Concrete Draws Interest

The second session was devoted entirely to architectural concrete, three illustrated papers of unusual interest having been presented. The first, by Alfred Chapman, of Chapman & Oxley, architects, Toronto, discussed concrete as a medium of architectural expression in buildings. The second paper, by Walter T. Steilberg, architectural engineer, Berkeley, California, was read by Arthur R. Lord because of the absence of the author. The third paper, by John J. Earley, architectural sculptor, Washington, D. C., was devoted mainly to the story of shop and erection methods employed in casting and erecting the ornamental concrete work for the dome of Baha'i Temple, Wilmette, Illinois. The story of the painstaking details involved in this work was a revelation to those not familiar with Mr. Earley's methods.

Arthur R. Lord, new president of American Concrete Institute

Cold Weather Concreting

Methods of protecting concrete work in cold weather were under discussion during a considerable part of the third session. R. B. Young and Wilfrid Schnarr, both associated with the Hydro-Electric Power Commission of Ontario, presented two papers on this subject. The first, on "Principles of Heating Concrete Mixtures in Cold Weather," covered problems such as temperatures required at the forms for different types of construction, heat losses in the forms, heat losses during transportation, temperatures of materials as received, supplying heat to the concrete mixture, and methods employed in heating aggregates and water on the job. The paper on "Cold Weather Protection of Concrete," by the same authors, was a sequel to their first paper.

"Temperature Effects on Concrete Strength," by A. G. Timms and N. H. Withey, of the Portland Cement Association, described the results of laboratory tests by the association, made to determine the strength of concrete from both normal and high-early-strength cements, exposed for various periods to temperatures of 50, 30 and 16 deg. F.

Boulder Dam Cement

The cement for Boulder Dam was up for further discussion in the fourth session in a paper by Prof. Raymond E. Davis and G. E. Troxell, R. W. Carlson and J. W. Kelly, of the University of California. This paper, presented by Prof. Davis, comprised a report on the continuation of the investigation of cement for this great structure, first reported at the annual convention in February, 1933.

F. R. McMillan, director of research for the Portland Cement Association, and T. C. Powers, associated with Mr. McMillan, offered a paper on "A Method of Evaluating Admixtures." Presented by Mr. McMillan, this paper discussed the function of admixtures in concrete, and methods for determining their comparative values.

Vibrating Concrete

S. B. Morris, superintendent of construction on the Norris Dam project, Tennessee Valley Authority, Knoxville, Tenn., opened the fifth session with a description of the use of high-frequency vibrators on Pine Canyon Dam, California, and told how vibration produced greater density, better bond between lifts, better surface appearance.

The fifth session also included discussions by Prof. H. M. Westergaard, University of Illinois, and by Prof. S. C. Hollister, Purdue University, on "Stresses at a Crack." Prof. Westergaard has made an exhaustive mathematical study of this subject, the general principles of which he explained. Prof. Hollister, likewise, made a study in this field by means of polarized light, and he presented the results of his investigation to the convention.

Rigid-Frame Concrete Bridges

Rigid-frame reinforced concrete bridges constituted the principal topic for the sixth (and final) session, and much of the data presented on this subject came from Canadian contributors. Arthur Sedgwick, bridge engineer, Ontario Department of Highways, read an illustrated paper on "Rigid-Frame Highway Bridges in Ontario," in which the economies of this type were set forth. The same may be said of the paper by H. S. Van Scoyoc, of the Canada Cement Co., on "Present Tendencies in Canadian Railway Bridge Design." A Canadian railway structure of this type is described in an illustrated article in the January (1934) issue of CONCRETE.

Rigid-frame construction of another type was discussed by Prof. F. E. Richart, University of Illinois, in a paper prepared by him in collaboration with R. L. Brown and T. G. Taylor. This report summarizes the results of tests of a number of reinforced concrete rigid frames subjected to sustained loading and kept under observation for two years. The special purpose of the tests is to observe the effects due to shrinkage and plastic flow.

Medals to Earley and Mercer

At the annual dinner of the Institute, the Leonard C. Wason Bronze Medal for contributing the most meritorious paper to the 1933 *Proceedings* was awarded to L. Boyd Mercer, of Melbourne, Australia, for his paper on "Sliding Form Work."

The Henry C. Turner Gold Medal "for notable achievement in, or service to, the concrete industry" was awarded to John J. Earley, architectural sculptor, Washington, D. C., for his marvelous work in developing concrete as an architectural medium.

Lord Elected President

Arthur R. Lord, consulting engineer, Chicago, was elected president to succeed Prof. S. C. Hollister, of Purdue University. F. R. McMillan, director of research, Portland Cement Association, is the new vice-president, and Harvey Whipple was re-elected as secretary. New directors include R. B. Young, first district; A. W. Stephens, second district; C. H. Scholer, sixth district; and Raymond E. Davis, John G. Ahlers, and B. F. Affleck, new directors-at-large.

Along the Highway—Brick on Concrete Roads

(From W. G. Sibley's column in Chicago Journal of Commerce, Nov. 21, 1933)

SINCE Pennsylvania Avenue in Washington was paved with wooden blocks, away back in the 1870's, in the time of Boss Shepard (was it not?), paving block men occasionally take on the ways of Ah Sin in "Plain Words from Truthful James." Recently this remark appeared in this column:

"We have seen no public verbal justification for building a concrete road and then covering it with brick. The belief is that the brick are laid solely for the financial profit of the brick manufacturers. Certainly they are an unnecessary expense."

This casual remark, born of a statement by a gentleman when we expressed wonder at seeing great loads of bricks stacked up on one side of a new concrete road, was caused by surprise when we were told that the brick were to be laid on the concrete in order that the paving block men might get "their share" of profit out of the new highway—a political stratagem, pure and simple.

It fell under the observation of the National Paving Brick Association at Washington, which regards the remark as "very damaging to the paving brick industry and not in accordance with the facts." We cannot concur in this opinion, which we regard as far-fetched, and as innocuous as a bad smell in a windstorm.

"We are," says the managing director of the Washington association, "herewith filing a protest and requesting an explanation." Very well. What we have said is the explanation. If it does not appear to be in "accordance with the facts," the stretch of brick paving on top of solid concrete is in evidence, where the gentlemen in Washington who protect the sanctity and purity of the paving brick industry, and are, we trust, well paid for doing so, may start something by an investigation. Certainly we are conscious of no offense in our paragraph, and no purpose to injure the industry concerned, but rather to promote public economy in road building, and stop laying a brick road on top of new concrete roads under any pretext.

We feel entitled to an apology from the Washington office for assuming to administer a reproof to this column when ignorant of the facts. There is too much of that sort of thing going on in Washington, where fault-finding with the press is prevalent.

✦ EDITORIAL ✦

Specialties for the Products Manufacturer

THE concrete products industry will always find some demand for standardized concrete building units.

Profit on these standardized wall and partition units, however, are likely to be small, for almost everywhere they must be sold in competition with hollow clay tile, a low-priced product. The superior quality of concrete units will always permit a higher selling price; but if the price differential is too great, the temptation to buy the cheaper and inferior clay product becomes too powerful.

Manufacturers of concrete products, therefore, should develop their markets for products that are not in direct competition with hollow clay units, for such products can be sold at a reasonable profit.

Notable among these special products is the lusty newcomer—the precast reinforced concrete floor joist. Another is the long-span concrete roofing slab.

In addition, there is a long list of concrete products that can be marketed at a fair profit because they are in competition with more expensive materials. These include concrete ashlar units, colored flagstones, cast stone, precast mantels, garden ornaments, lighting standards, poles, well and cistern lining units, septic tanks, manhole block, incinerators, and others.

Finally, we have the premier specialty of all—the concrete burial vault. With an active competitor in its field, the concrete vault is growing rapidly in public favor and it dominates the market completely in many sections. It has been the salvation of many a products manufacturer during the last four years.

The concrete products industry, while pushing standard building units to the limit, must give equal attention to the development of specialties made of concrete alone, or which have a cost advantage over other materials.

The Place for Special Cements

AT the annual meeting of the American Concrete Institute in Toronto during the discussion of the paper by Raymond E. Davis on the special cement developed for Boulder Dam, the author made a statement that should be taken into consideration by all who select or specify cement.

In effect, Professor Davis explained that the type of cement developed for Boulder Dam would not be suitable for structures in which the concrete is subjected to alternate periods of moisture and drying out. The volume changes would be excessive.

It will be a distinct service to the construction industry to have special cements developed for special purposes, as in dams and other massive structures, in structures exposed to sea water, or to running water, or to extremes of temperature variation.

Doubtless a large demand will be developed for such special types of cement. But no one should lose his head; ordinary portland cements and high-early-strength cements will continue to be used for the great majority of structures.

Give Us Roads That Will Last

IN a number of states local newspapers are raising loud protests against state highway departments who specify road surfaces inferior to concrete, for projects under the 400 million PWA fund.

The most sustained protests of this character are heard in Wisconsin. In an editorial headed "Anything Is Good Enough for Northern Wisconsin," a weekly newspaper protests the selection of gravel surfacing for an important road in that section of the state. "Why waste this money just because it comes as a gift from the federal government?" asks this editor. "Why not give us roads that will last, even if we get less mileage?"

Later a similar howl came from the western part of the same state, because of the selection of an inferior type of surface for the closing link in a principal east-and-west highway. One editor in that section demands "concrete or nothing."

Who can deny that there is sound logic in these demands? These editors know the desires of their communities, and they know how to express those desires in language that state highway directors should be able to understand.

C W A Projects That Are Worth While

CONCRETE airport runways in San Francisco; reinforced concrete high school athletic stadiums in Wichita, Kansas, and Maywood, Illinois; basements built under country schools in Wisconsin; an old building remodeled into a public library in Salisbury, Maryland—these are only a few examples of worth-while CWA construction projects.

From all sections of the country come reports of similar enterprise on the part of local boards. If any CWA workers are still being employed on trivial projects of the made-work type, the fault lies wholly with local engineers, architects and construction men, who have not taken the trouble to develop more useful employment.

Local CWA boards have welcomed constructive aid in the selection of projects that will serve a useful purpose. The concrete construction industry must accept the blame if that aid has not been given.

PROGRESS — In a Page

Current activities in research, in matters pertaining to concrete and cement, as being carried on or completed by various organized groups.

Highway Research Abstracts

HIGHWAY Research Abstracts No. 6, an 8-page multigraph dated January, 1934, has been issued by the Highway Research Board, 2101 Constitution Ave., Washington, D. C. Subject-matter covered in highly condensed abstracts in this issue includes, among other items—

(1) Newly Acquired Knowledge of Cement and Concrete Aggregates, by F. O. Anderegg.

(2) Isteg Bars for Reinforced Concrete, from staff article in *Engineering* (London).

(3) Effect of Angularity of Particles of Aggregates in Mortar and Concrete Mixtures, issued as report by the bureau of materials, Illinois Division of Highways.

(4) Tests of Composite Wood and Concrete Beams, by J. F. Seiler.

(5) The Rheological Properties of Cement and Cement-Mortar Stone, by E. C. Bingham and Markus Reiner.

Copies of the January "Abstracts" may be obtained on request addressed to the Highway Research Board; but for future issues there will be a charge of 15 cents a copy. It is expected that about ten issues will be published in 1934.

Report on Tests of Concrete Soon Available

THE American Society for Testing Materials will soon publish the Report on Significance of Tests of Concrete and Concrete Aggregates, assembled under the auspices of Committee C-9 during the past year and presented at the Thirty-sixth Annual Meeting. The purpose of this compilation is to present an effective summation of the significance, limitations and applicability of the more widely used tests for concrete and concrete aggregates, including discussions of their importance, whether they convey a true picture of what can be expected, and other pertinent factors.

The material was compiled under the direction of a committee consisting of R. W. Crum, chairman, A. T. Goldbeck and F. H. Jackson, and was reviewed by the entire membership of Committee C-9, which approved it.

It was found impossible to preprint the report and include it in the *Proceedings*, but it will be issued as a separate publication, available about March 15. Copies can be purchased at $1 each.

Ready-Mixed Concrete and Light-Weight Aggregates

IN response to an urgent need for specifications for ready-mixed concrete, due to the increasing use in all types of construction of concrete from central mixing plants, Committee C-9 of the American Society for Testing Materials drew up a complete set of requirements for the materials, proportioning, mixing, delivery, quality, testing, inspection and acceptance of ready-mixed concrete for all purposes. Suggested modifications of the specifications have been received since its publication and are being considered.

The proposed specifications for light-weight aggregate that were withdrawn from the preprinted report of Committee C-9 are being revised in the light of numerous criticisms and suggestions received.

British Investigations of Cements and Concrete

THE annual report of the Building Research Board of the Department of Scientific and Industrial Research (London, England) describes a number of investigations of cements and of concrete now being pushed forward under the auspices of the Board. The investigations include work on the constituent components of fresh and set cement, free lime in fresh cement, fineness and rate of hydration, crazing of concrete products, and the properties of pigments used in concrete. Work is also being carried out on the strength development in mass concrete and the effect of maturing temperature on the strength of concrete and on the action of sea-water on concrete.

Tests are also being conducted on the effect of impact during the driving of reinforced concrete piles, these tests being made in co-operation with the Federation of Civil Engineering and Public Works Contractors.

Copies of the annual report may be obtained at 2s. 6d. from His Majesty's Stationery Office, Adastral House, Kingsway, London, W. C. 2, England .

1933 Index to A. S. T. M. Standards

THE 1933 Index to A. S. T. M. Standards and Tentative Standards, a book of 124 pages with heavy paper cover, has been issued by the American Society for Testing Materials.

The number of standards and tentative standards issued by the A. S. T. M. now totals 689. Copies of the Index may be obtained without charge by addressing the A. S. T. M. headquarters at 260 South Broad St., Philadelphia, Penna.

A. S. T. M. Committee Meetings

AMONG the committees of the American Society for Testing Materials who are to hold meetings at the Wardman Park Hotel, in Washington, from March 5 to 9, are Committee C-1 on Cement, C-9 on Concrete and Concrete Aggregates, C-10 on Hollow Masonry Building Units, and C-13 on Concrete Pipe.

Further reference to these committee meetings will be found on page 24 of the February issue of CONCRETE.

List of American Standards

THE American Standards Association, 29 West 39th Street, New York, has issued a 20-page pamphlet containing a list, by title and serial number, of all standards approved by that association. Copies of the list may be obtained on request.

Design Masonry Mortars to Meet Structural Requirements

By EUGENE S. POWERS

Consulting Architectural Engineer, Philadelphia, Penna.

IN your issue of November, 1933, there are two articles that prompt me to express some ideas regarding masonry mortar that are the result of my experience, study and reflections. I have never seen anything written on masonry mortars that gives a sufficiently complete picture of their functions. Often the idea seems to be missed, that mortars, to give the best results in masonry, have to be designed and fabricated for the particular job, or the particular service the masonry is to perform.

One of the articles I refer to is entitled "Masonry Cements Must Be Pre-Mixed." In this excellent article, this paragraph occurs: "The need for using a reasonable amount of portland cement, or a cement having properties similar to portland, in mortars for masonry construction has never been demonstrated more emphatically than in the southern California earthquake which occurred on March 10 of this year." The inference is that masonry mortars should always have portland cement, or its equivalent in them, regardless of where the structure is located in which the mortar is to be used. The type of masonry and its function in the general scheme of construction should also be taken into account.

Mortar Requirements Vary with Conditions

The last paragraph in this article states, "Sands for masonry mortars should be of such gradation that all particles will pass the No. 8 sieve, with not more than 30 per cent passing the No. 50 sieve, and not more than 3 per cent passing the No. 100 sieve." The conception back of this assertion is, obviously, density and minimum surface area, the same as in designing concrete. Some problems may require a mortar with a minimum possible amount of plastic material, as when the architectural design calls for a very wide or high joint that would settle too much, if the work proceeded normally, before the mortar had time to stiffen up. While it is true for such problems, it is the wrong mental picture for the designer to have in the majority of cases.

In the majority of cases the best results can be obtained from mortar that has a considerable excess and not a minimum amount of cementitious materials, whether of cement or lime, or a combination of both. It should be apparent that the importance of carefully graded sand varies with the amount of cementitious material used.

High Mortar Strength Not Always Needed

The second article to which I refer is entitled "Less Shrinkage, Better Workability, with Prehydrated Mortar," by E. Y. Bragger. It seems obvious that the importance of prehydration varies with the character of the cementitious material, with the ratio of portland cement to lime. The ratio of cement to lime should certainly be dependent on the character of the masonry and the results expected from it. Some masonry would function better if laid up in fairly weak mortar rather than in quite strong mortar. When the mortar is strong enough to bind all the units into a monolith, there is danger of cracks developing in a long wall due to expansion and contraction. Where such strong mortar is necessary the danger of this effect should be considered and provision made to prevent it, the same as would be done in concrete design.

Both of these articles are excellent examples of the work that is being done in this field to furnish engineers with information useful in designing mortars.

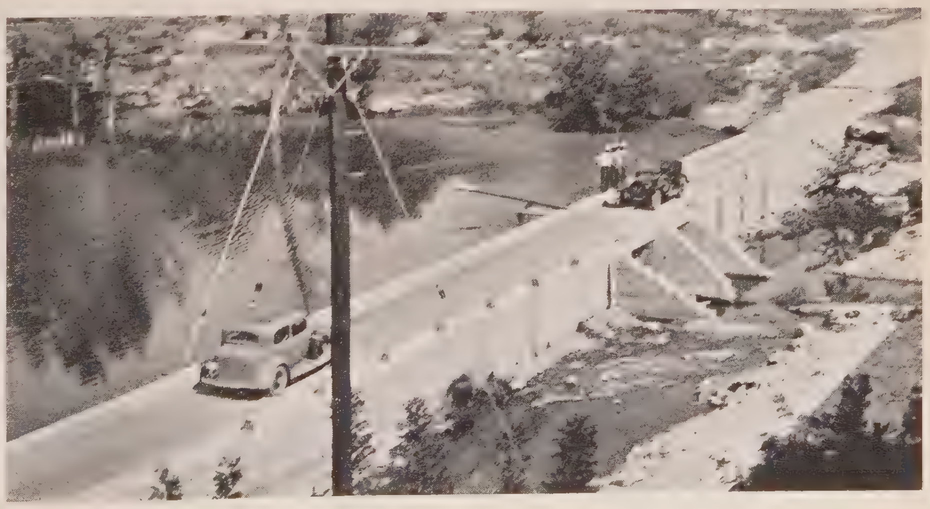
Texas Low-Level Bridges Now Serve as Water Conservation Dams

TRAVELERS on Texas highways are familiar with the low-level concrete bridges of that section, designed and built of the size necessary to take the ordinary flow of the stream, but with the knowledge that for a few hours during a sudden and heavy downpour the structure will be completely submerged.

Now the idea has been carried further, for the low-level roadways crossing the stream valleys are built also as dams, to impound and conserve the heavy stream flows. More than 600 structures of this type have been built in Texas, and a much larger number is proposed for the forthcoming construction program.

The roadway-dams thus far built range from 5 to 15 ft. in height. In many cases, in fact, dams have been built to conserve water, without provision for a roadway.

Besides serving as roadways, low-level bridges, and as a means of conserving water, the dams form lakes and ponds that are utilized for recreational purposes.



One of 600 concrete structures in Texas that serve the combined purpose of low-level bridges and dams for conservation of water resources

Maintain Cement-Bound Macadam at Small Cost

Cement-bound macadam pavement in Union Avenue, Portland, Oregon, placed in 1911, and still in excellent condition

PORTLAND, Oregon, was one of the cities that placed a large yardage of cement-bound macadam pavement about 20 years ago, when that form of pavement was known as the Hassam type. From 1908 to 1918 that city placed nearly 1,000,000 sq. yd. of this type.

Since 1918 the city has kept a careful maintenance cost record on all street pavements, and these costs have been kept separately for the various types placed.

For both concrete and cement-bound macadam, the record shows a most commendable performance. The table here given shows the average annual maintenance costs per sq. yd. for the 15-year period from 1918 to 1932, inclusive, and also, in the last column, the maintenance cost per sq. yd. in 1932.

One of the most significant things about these figures is that the cost of maintaining the cement-bound macadam pavements in 1932 was practically no greater than the average annual cost for the entire 15-year period, even though in 1932 the ages of these pavements ranged from 14 to 24 years. This should be reassuring news to highway engineers, for it establishes the fact that cement-bound macadam is a durable paving type.

MAINTENANCE COSTS, BY TYPE, ON STREET PAVEMENTS OF PORTLAND, OREGON

	Total Yardage Placed, 1908 to 1918	Average Annual Maintenance, Costs per Sq. Yd. For 15 Yr. Period, 1908 to 1918	For 1932 alone
Cement-bound macadam	987,988	$0.0030	$0.0033
Portland cement concrete	471,350	.0037	.0034
Sheet asphalt on concrete base	1,794,031	.0106	.0189
Black top on crushed rock base	2,343,345	.0078	.0070
Black top on bituminous base	777,835	.0056	.0117

The portland cement concrete pavements have given an equally good service, the maintenance cost in 1932 having been slightly less than the average for the 15-year period.

Build Concrete High School Stadium With CWA Money

A CONCRETE stadium 183 ft. long, 48 ft. wide and 26 ft. high, seating 1,550 spectators, is under construction for the Proviso Township High School at Maywood, Illinois, as a CWA project.

Raising Money for Materials

Under CWA regulations, it was necessary for the community to raise $2,527 as its half of the cost of materials, estimated at $5,054.

The high school athletic association had on hand a fund of $1,200, accumulated over a period of years as a stadium construction fund. The association donated this amount, plus an additional amount of $500, toward the purchase of materials. The remaining amount of $827, required to bring the total sum to $2,527, was raised by the senior high school class.

The cost of labor on this project, all of which is paid by the CWA, approximates $16,900. This includes the construction of a quarter-mile track. The total cost of the stadium and track will, in consequence, approximate $22,000, or about $14.20 per seat.

Labor cost on the project ran high, for the reason that union labor was used throughout, and the lowest rate paid—for common labor—was 82½ cents an hour. Some of the skilled labor was paid $1.50 an hour. Maywood is a suburb of Chicago, so that Chicago labor prices prevailed. In outlying communities not dominated by union labor it should be possible to build a stadium of this size at $10 per seat, or less.

The stadium was designed and supervised by Leo Strelka, of Maywood, who was appointed consulting engineer for the project.

Co-ordination of Basic Principles of Concrete Mixtures

Water Content, Aggregate Content, Optimum Fineness Modulus and Laws of Grading Are Discussed in Fourteenth Article of Series

XIV—Supplementary Principles and Co-ordination (Continued)

By JOSEPH A. KITTS
Consulting Concrete Technologist, San Francisco, Calif.

IN the chapter immediately preceding,[1] the law of the cement content is discussed. This chapter takes up the law of the water content; the law of the aggregate content; the law of the optimum fineness modulus; and the laws of grading.

(2) LAW OF THE WATER CONTENT

It has been shown in Chapters VI to XII that the Abrams water-cement ratio strength equation—

$$S = a/b^{w/c} \quad \ldots\ldots\ldots \quad (21)$$

is the true law of strength of plastic, fluid, and workably graded concrete mixtures, for w/c varying from 0.5 to 1.0, and that for w/c greater than 1.0 it is on the safe side in its indication of strength. It has also been pointed out by many examples that there are no absolute values of a and b fitting all physical and technological conditions. Values of a and b must be determined for the actual conditions obtaining on the job.

Under the conditions given in Chapter XIII for the P. C. A. 1927 criteria of skilled control, the equation is—

$$S = 14{,}000/7^{w/c}$$

in which S is the compressive strength in lb. per sq. in. (for 6 by 12-in. concrete cylinders, made, capped, cured, and tested at 28 days, all accurately in accordance with the then current A. S. T. M. standards), and w/c is cu. ft. of water to 94 lb. of cement, with allowance for absorption of water by the aggregates and deduction for free water with the aggregates. The usable form of the equation is—

$$\log S = 4.14613 - 0.8451\ w/c$$

Plotting strength to logarithmic scale, as ordinate, against w/c to natural scale, as abscissa, the graph of the relation is a straight line showing a decrease of strength with increase of water-cement ratio. For the purpose of determining the amount of water (or cement) per unit volume of concrete, the equation is incomplete because it involves two unknowns—the volumes of water and cement per unit volume of concrete.

Co-ordinating the Abrams law of the water-cement ratio with the author's law of the cement content per unit volume of concrete, the law of the water content is expressed by the equation—

$$W = fC\ (g - \log K_s) \quad \ldots\ldots \quad (52)$$

in which W is the volume of water and C is the absolute volume of cement (by the author's Eq. 38) in a unit volume of concrete, K_s is the unit compressive strength of the concrete at a given age, and f and g are constants depending on the physical and technological conditions as determined by the cement and aggregate quality, time and efficiency of mixing, skill of technological control, and age of concrete.

The equation of the water content per cubic yard of concrete, based on the P. C. A. 1927 criteria for skilled control, is—

$$W_{27} = 0.0126\ C\ (4.14613 - \log K_s) \quad \ldots \quad (52a)$$

in which W_{27} is the cubic feet of free mixing water per cubic yard of concrete, K_s is the compressive strength of the concrete at the age of 28 days, and C is pounds of normal 1927 standard portland cement per cubic yard of concrete as determined by the author's equation (38) and constants A and B of Table 2, page 14, CONCRETE, December, 1931.

(3) LAW OF THE AGGREGATE CONTENT

Feret's discovery about 1890 of the elementary volumetric composition of concrete mixtures has shown that the ingredients fit together as absolute volumes with a small correction for entrapped air. More recent research has shown that a small correction must also be made for cement going into solution with the mixing water.

Let K_v = unit apparent volume of set concrete;
R_v = absolute volume proportion of aggregate;
C_v = absolute volume proportion of cement;
W_v = absolute volume proportion of mixing water;
and K_y = yield of the sum of the absolute volumes of the ingredients, the yield increasing with entrapped air and decreasing with cement going into solution with the mixing water. That is—

$$K_y = K_v/(A_v + C_v + W_v) \quad \ldots\ldots \quad (36)$$

The law of the yield, K_y, will be presented under item (6). The law of the aggregate content is, then—

$$R_v = (K_v/K_y) - (C_v + W_v) \quad \ldots\ldots \quad (36b)$$

in which K_y may be assumed as unity, and C_v for one cubic yard of concrete is equal to $C/194$ for normal standard portland cement.

R_v, the absolute volume of aggregate in the mix, will be composed of two or more separated sizes of rock particles, fine sand, coarse sand, fine gravel, medium gravel, coarse gravel, large gravel, cobbles, and possibly sizes up to stones 12 in. in diameter. The determination of proportions of the separated aggregates will be given under items (4) and (5).

Having determined the individual proportions of aggregates, the measures by bulk volume and weights are readily determined by equations (3) and (8), Chapter II.

---

[1] February (1934) issue of CONCRETE, pages 13-16.

(4) LAW OF THE OPTIMUM FINENESS MODULUS

The researches of Feret, Fuller and Thompson, Abrams, and Talbot and Richart have shown that the coarsest workable grading of aggregate, with a given cement content, produces concrete of the highest density and strength for the given cement content, maximum size of aggregate, and workability, flowability and cohesion of mix; that increase of maximum size, accompanied by a corresponding increase of coarseness (fineness modulus), increases the density and strength; and that increase of cement content permits an increase of coarseness of grading resulting in greater density and strength for the new cement content.

The grading of aggregate producing highest density and strength with a practical cement content is relatively coarse; the resulting concrete is harsh and difficult to work and lacks cohesion between rock particles and cement mortar in the fresh mix. The practical grading, as shown by Fuller and Thompson, is somewhat finer than the "ideal" or maximum concrete-density grading, and is properly designated as the optimum concrete-density grading.

The mixed aggregate which produces the highest practical or optimum density of concrete with a given cement content is not the mixed aggregate of highest density; it is somewhat coarser and with greater voids, and the cement-water mortar fills these voids with 30 to 40 per cent excess essential to workability, flowability and cohesion of the fresh mix, this excess requirement increasing with decrease of maximum size.

Abrams' graphs of fineness moduli for various cement contents and maximum sizes of aggregates, as shown in Figures 12 and 13, "Design and Control of Concrete Mixtures," P.C.A. 1927, have proved to be substantially correct criteria of the optimum coarseness of grading of rounded gravel aggregates for the maximum workable density and strength of concrete for a given cement content, provided the mixed aggregate contains particles ranging fairly uniformly from zero to the given maximum diameter. The graphs show fineness modulus values for various cement contents and maximum sizes of aggregates as given in Table 13.

TABLE 13.—FINENESS MODULI FOR VARIOUS CEMENT CONTENTS AND MAXIMUM SIZES OF ROUNDED GRAVEL AGGREGATE

From Figures 12 *and* 13 *"Design and Control of Concrete Mixtures,"* 1927, *by Portland Cement Association*

Pounds of Cement	Maximum Size of Aggregate				
per cu. yd.	¾ in.	1 in.	1½ in.	2 in.	3 in.
310	4.67	5.10	5.49	5.90	6.34
488	4.90	5.31	5.71	6.14	6.55
733	5.12	5.51	5.93	6.36	6.76
1034	5.28	5.65	6.08	6.50	6.91
1560	5.43	5.83	6.22	6.67	7.10

Plotting cement content, C, to logarithmic scale, as ordinate, and fineness modulus, *f.m.*, to natural scale as abscissa, the values of Table 13 show a straight line for each maximum size of aggregate. Therefore, the law of the fineness modulus is—

$$f.m. = s(\log C + e) \quad \ldots\ldots\ldots \quad (53)$$

The line for each maximum size has the same slope, and, therefore, s is a constant for all maximum sizes, D. The differences in fineness moduli for any cement content are equal between ¾ and 1½ in., 1½ and 3 in., and 1 and 2 in.; the fineness moduli increase with the maximum size; and, therefore, the fineness modulus increases as the logarithm of the maximum size. Then, since s is constant, e increases as the logarithm of the maximum size. The practical equations based on values from Table 13 are—

$$f.m. = 1.1(\log C + e) \quad \ldots\ldots \quad (53a)$$

$$\text{and} \quad e = 2.1 + 2.5 \log D \quad \ldots\ldots \quad (54)$$

in which *f.m.* is the fineness modulus, C is pounds of cement per cubic yard of concrete, D is the maximum (square hole) size of aggregate in inches, s equals 1.1, and logarithms are to the base 10.

Given two aggregates—fine and coarse—they may be combined by simple mathematical proportion for any fineness modulus between the moduli of the two, as shown in 1918 by Abrams, in Bulletin 1, S.M.R.L., Lewis Institute, and in "Design and Control of Concrete Mixtures" P.C.A., 1927, which likewise provides only for two separation sizes of aggregates—fine and coarse.

Since 1900, if not before, there has been practical and technical need for an expedient algebraic method of combining three or more size separations of aggregates with proper relation to cement content, workability, strength, durability and economical quality. The advent of the commercial concrete factory, about 1925, introduced the positive necessity of expedient algebraic calculation of scientifically exact proportions of three to six or more size separations for concrete mixtures of any given maximum size, strength, slump, and of correct volume.

(5) THE LAWS OF GRADING

Between 1890 and 1895 Feret graphically represented the granular structure of aggregate mixtures, the corresponding densities and strengths of concretes therefrom, developed the first principles of grading, and, no doubt, was the father of modern scientific thought along these lines. Quite important to the principles of grading, he showed that the ingredients of the concrete mixture fit together as absolute volumes.

Between 1901 and 1907, Fuller and Thompson developed the "Fuller" curve of grading, which established the principle that the maximum practical density and strength, for a given cement content, is obtained by uniform grading of three or more size separations to the maximum workable coarseness. The Fuller-Thompson method was adopted throughout the world and is, today, perhaps the most widely used scientific method of proportioning. Owing to a slow, tedious, inexact, cut-and-try procedure of calculation and graphical analysis, to inadequate criteria of coarseness, and to a lack of a unit of measure of the screen analysis, such as the fineness modulus, the method is not the acme of accuracy and convenience.

In 1918, Abrams introduced a scientific sieve scale and supplied a unit of measure of the screen analysis, the fineness modulus; and, in 1927, he presented substantial criteria of the optimum fineness modulus, for various maximum sizes of aggregates and cement contents, applicable to the combination of two size separations.

In 1923, Talbot and Richart presented a simple grading equation adaptable to any maximum size and coarseness, showed its values in relation to the Abrams sieve scale and fineness modulus, and furnished comprehensive criteria of its efficiency in producing concrete of higher strength and density for a given cement content, maximum size, and consistency. The Fuller-Thompson combination ellipse and straight line grading appears to be the most efficient type of grading curve, with respect to strength and density, but the Talbot-Richart grading is practically of equal efficiency and is more convenient and adaptable.

In 1925, the author co-ordinated Abrams "maximum permissible fineness modulus," Feret's absolute volume basis of proportions, and the Talbot-Richart grading equation, and developed the essential technique of adaptation for both field and laboratory use. The laws of cement content and fineness modulus were discovered in January, 1929, and the present development of the grading calculation method was perfected in April, 1931. This co-ordination has been employed and developed on several million cubic yards of concrete production since January, 1925, and has proved that it contains all the essential elements of a complete grading system of practical simplicity, scientific exactness, and speed of calculation. The student should appreciate that the simplicity and logic of this grading technique is not due to natural facts readily recognized, but, rather, that it is the result of research extending over more than forty years in many parts of the world, of thousands of hours of study by many individuals, and of co-ordination of elements conceived by many different minds.

The Fuller-Thompson, Hermann, Graf, Kitts-Peugh, and other grading curves of merit, are all practically of the same general shape as the Talbot-Richart curve, the principal characteristic of which is uniform continuity of change of volumes and sizes of particles from zero to the maximum diameter. The Talbot-Richart curve has convenient mathematical and practical features which will be shown.

Mathematical Features of the Talbot-Richart Curve

The grading equation employed by Talbot and Richart, in Bulletin 137, Engineering Experiment Station, University of Illinois (October 15, 1923), is—

$$P = 100(d/D)^n \quad \ldots\ldots\ldots\ldots \quad (39)$$

in which P is per cent of the whole aggregate passing a given sieve having openings of width d, D is the maximum size of particle of the given aggregate, and n is a variable exponent determining the coarseness of grading.

Employing proportion instead of per cent, and co-ordinating it with Abrams' fineness modulus principle, the following forms of the equation were found most convenient:

$$p = (d/D)^n \quad \ldots\ldots\ldots\ldots \quad (39a)$$

$$\text{and } r = 1.0 - (d/D)^n \quad \ldots\ldots\ldots\ldots \quad (39b)$$

$$\text{or } \log p = \log(1.0 - r) = n(\log d - \log D) \quad \ldots \quad (39c)$$

in which p is the total proportion by absolute volume passing, and r is the total proportion retained on, any square-hole sieve opening of d width, D is the maximum size by square-hole measurement, and n is an exponent varying with the fineness modulus.

The practical values of n vary from about 0.44 to 0.66, and that for 5 to 6 sacks of cement per cubic yard of concrete is about 0.50, or a parabolic grading.

A convenient peculiarity of equation (39b) in connection with the Abrams sieve scale is that, for any given value of n, the same succession of r values are obtained for D values in the ratio of 2, such as ¼, ½, 1, 2, 4, 8 in. and 3/16, ⅜, ¾, 1½, 3, 6 in., etc., as shown in Table 14. Thus, by computing

$$r = 1 - (d/8)^{0.52}$$

for the Abrams sieve scale values of d, as an example, we have all the r values for the determination of the fineness modulus of 8, 4, 2, 1 in., and other corresponding maximum sizes. Further, the equation $r = 1 - (d/3)^{0.52}$ is the 0 to 3 in. part of $r = 1 - (d/8)^{0.52}$, as a typical example shown in Table 14.

TABLE 14.—CHARACTERISTIC VALUES OF r IN THE GRADING EQUATION, $r = 1 - (d/D)^n$, AND CORRESPONDING FINENESS MODULI

		Values of D and n						
Sieve	Theoretical	$D = 8$ in.	4 in.	2 in.	1 in.	½ in.	¼ in.	3 in.
No.	d, in.	$n = 0.52$	0.52	0.52	0.52	0.52	0.52	0.52
100	0.005859	0.98	0.97	0.95	0.93	0.90	0.86	0.96
50	.011719	.97	.95	.93	.90	.86	.80	.94
30	.023437	.95	.93	.90	.86	.80	.71	.92
16	.046875	.93	.90	.86	.80	.71	.58	.89
8	.09375	.90	.86	.80	.71	.58	.40	.84
4	.1875	.86	.80	.71	.58	.40	.14	.76
⅜ in.	.375	.80	.71	.58	.40	.14	.00	.66
¾ in.	.75	.71	.58	.40	.14	.00	.....	.51
1½ in.	1.5	.58	.40	.14	.00	.....	.....	.30
3 in.	3.0	.40	.14	.00	.....	.....	.....	.00
6 in.	6.0	.14	.00	.....	.....	.....	.....	.....
8 in.	8.0	.00	.....	.....	.....	.....	.....	.....
Fineness Modulus		8.22	7.24	6.27	5.32	4.39	3.49	6.78

The important and essential fact shown by Table 14 is that, for any value of n, we can determine the fineness moduli of the 0 — 3/16, 0 — ¼, 0 — ⅜, 0 — ½, 0 — ¾, 0 — 1 in., or any other like parts of the whole aggregate, as given in Table 6, CONCRETE, December, 1931, and these can be applied in connection with the fineness moduli of the job aggregates, to the determination, by simple arithmetical calculation, of proportions of any number of size separations for any fineness modulus as determined by the fineness modulus law.

Proportioning Two Aggregates

Let p = proportion of finer aggregate
Then $1.0 - p$ = proportion of coarser aggregate
Let S = fineness modulus of finer aggregate
R = fineness modulus of coarser aggregate
and M = required fineness modulus of mixed aggregate.
Then $M = pS + (1.0 - p)\,R$
and $p = (R - M)/(R - S) \quad \ldots\ldots \quad (55)$

This is the method shown by Abrams, in 1918.

Proportioning Three or More Aggregates

Assume $D = 1$ in.
$M = 5.32$ (by Eq. 53a)

and job aggregates are—

	A	B	C
Max. Size	1 in.	¼ in.	⅛ in.
f.m.	7.00	4.00	2.00

The theoretical fineness modulus of the 0 — ¼ in. part of the whole is shown by Table 14 to 3.49, and is made up of aggregates C and B.

Employing Eq. 55—

$$\frac{\overset{(A=R)\quad(M)}{7.00-5.32}}{\underset{(A)\qquad(S)}{7.00-3.49}} = p = 0.48;\ 1.0 - 0.48 = 0.52 \text{ of } A$$

$$\underset{(p)}{0.48}\,\frac{\overset{(B=R)\quad(M')}{4.00-3.49}}{\underset{(B)\quad(C=S')}{4.00-2.00}} = 0.12 \text{ of } C;\ 0.48 - 0.12 = 0.36 \text{ of } B$$

The first operation is to combine the coarsest aggregate, A, with the theoretical fine ($B + C = 3.49$), for the required fineness modulus of the mix ($M = 5.32$). This shows 0.48 of the whole is composed of aggregates B and C, and 0.52 is aggregate A. The 0.48, B and C, are combined for the theoretical fineness modulus of the 0 — ¼ in. part, 3.49, and the results are 0.12 of C and 0.36 of B.

Any number of sizes may be computed in the same sequence, and the resulting grading is the nearest approximation, to the theoretical grading, possible with the given aggregates.

(To be concluded)

What the Concrete Masonry Industry Gains from the NRA

Control Is Back in Hands of Industry—Quality and Service Replace Price Cutting — Code Authority's Task—The Toronto Convention

By HORACE W. BUSH
Secretary, Concrete Masonry Code Authority,[1] Teaneck, N. J.

PRESIDENT ROOSEVELT'S "New Deal" policy and the birth of the NRA have been a salvation to industry, large and small. The shrinkage reported by the Department of Commerce was 32 billions of dollars in workers' pay in 1933 as compared with 1929. Is it any wonder the government was forced to adopt some method of providing for the stability of industry?

While business men continue to complain about some provisions of the NRA, there is a general disposition among them to become reconciled to the Act. At present there is no adequate substitute for the plan, and executives are beginning to feel that it will eventually work out all right. Practically unanimous agreement can be had on the belief that American industry can never return to the old order. Criticism has emanated chiefly from industries with purely selfish motives in their attempts to establish monopolistic practices through codes.

Control Returned to Industry

The government has kept its promise; it has returned the control of business back to business through Code Authorities. It insists, however, on giving a final O. K. to all plans and decisions. The policy of NRA officials all along has been to listen attentively to all that business has had to say and to give business every concession that did not infringe on the rights of labor or the general consuming public. My own experience in recent months, attending open hearings on codes and in consultation with NRA officials, is one of intelligent and courteous co-operation. So while the government will continue to be very much in evidence, to all intents and purposes, the Code Authority, which means business itself, will take the helm.

There are three distinct, major divisions of our Code.

First—*Labor:*

1. Shortening hours to increase employment.
2. Increasing wages to a decent living scale.
3. Bettering of working conditions.

Second—*Consumers:* In order to meet price competition, it is necessary to protect the consumer against inferior quality. Now a minimum requirement governs our product.

Third—*Individual Business:* To be conducted on the basis of a fair profit.

Very properly, labor and consumers are the first to be considered and derive direct benefits, but unless the Concrete Masonry Industry can earn a fair profit as well as provide a decent living wage for its employees, the recovery effort under our Code will not prove a permanent success.

Quality and Service, Instead of Price

Concrete products for the past few years have been sold on the basis of cut prices, granting of easy credit terms, and other concessions. By requiring full publicity with regard to prices, the concrete masonry code has made its most important and indispensable contribution to the stability of the concrete masonry industry. Our Code brings the price situation into the light of day by requiring immediate filing of prices. The result is that price is no longer a deciding factor. The factors are now—

1. Quality of product.
2. Convenience of delivery.
3. Services that may be legitimately performed for the consumer.

Competition is not lessened, but increased. It is directed into more healthful channels. Associations are in a position to render more service to products manufacturers than ever before. We do not intend to devote our efforts toward price fixing arrangements of one kind or another. Our Code Authority sees the opportunity of presenting a united front for the betterment of our industry, and we shall work for wider markets and increased consumption. We believe the NRA will permit industry to go a step further than actual compliance with the agreement.

Why the Code Authority Needs Support

Our Code Authority has taken upon itself a tremendous task—one of unification of the entire industry for the common purpose of administering the Code, the elimination of the unfair competitor, or chiseler, and the uplift of the industry through associations.

What the NRA and the Code can do for our industry depends upon the individual response. Manufacturers should lose no time in signing compliance with the Code, filing prices as provided for in the Code, paying the assessment and giving the Code Authority, with Uncle Sam wielding the "big stick," a chance to prove that the concrete products industry contributes a very definite and distinct service to the nation, and therefore has the right to exist.

The Toronto Convention

Let me add, further, that the annual meeting held in Toronto on February 19 and 20, in conjunction with the Concrete Products Association of Canada, has given the leaders of the concrete masonry industry much encouragement. The atmosphere about the convention was one

(Continued on page 24)

---

[1] Also secretary-treasurer, National Concrete Masonry Association.

Recovery Construction Program Will Use Concrete Products

By L. S. BRODD
District Engineer, Portland Cement Association, Milwaukee, Wisconsin

TODAY the concrete products manufacturer has competition, not alone from materials used for the same purposes as concrete products, but from manufacturers of automobiles, radios and home furnishings, all of whom are out after the consumer's dollar.

Among the various "New Deal" activities that have their source at Washington, those of particular interest to the concrete products industry are the CWA, the PWA, the AAA, the CCC, and the HOLC.

To paraphrase the prospector who declared "There's gold in them thar hills!" we may aptly say "There's business in them thar alphabets!"

Concrete Products in CWA Projects

At the present moment the CWA is holding the center of interest. A bill is now before Congress which is expected to extend this particular work to June 1, at least. The kinds of concrete products needed in CWA construction include manhole and catch basin block, sewer pipe, drain tile, wall and partition units for the remodeling of public buildings, special units for lining cisterns and water storage basins, special units for bank revetment, retaining walls, and bulkheads to prevent soil erosion, ornamental units, fences, and entrance gateway posts for park improvements, precast curb-and-gutter units, and numerous other types.

At this very moment many country and village school houses in Wisconsin are propped up on stilts while CWA workmen are excavating basements and building concrete block foundation walls and concrete floors under them. Here is an activity that requires personal work, calling on county or township CWA officials and convincing them of the utility of such improvements.

Large Market in PWA Construction

PWA projects, of course, are larger, on the average, than those in the CWA, and the opportunities for the concrete products manufacturer become obvious. In the construction or remodeling of city halls, school buildings, hospitals, federal buildings, slum clearance housing projects, subsistence homesteads, and the like, markets are being created for concrete wall and back-up units, partition tile, floor tile, roofing tile and fireproofing units.

In this case, also, the products manufacturer should take an active public interest in the selection and promotion of these projects. By appearing as a leader in these public activities, he will enhance his chances for getting some of the business when materials are purchased—provided, further, that he gets out and fights for the business.

Farmers in Possession of Cash

As to the AAA, products manufacturers will make a serious mistake if they overlook the farm market. During a recent conversation with an Iowa state highway official I was told that the AAA has placed $30,000,000 into the hands of Iowa farmers through loans of 45 cents a bushel on corn. These farmers, he said, are in possession of cash for the first time in three or four years. They are using this money to pay debts, to buy sorely needed machinery, to remodel existing buildings, and to construct additional accessory buildings.

Here is where the farm market differs from the home market in cities and towns. The farmer needs not only a house to live in—he needs other buildings for carrying on his work. He needs a barn, a milk house, a smoke house, an ice house, hog and poultry houses, storage cellars for apples and potatoes, manure pits, fence posts, tanks for water supply, linings for wells and cisterns, precast septic tanks, and various other buildings and accessories for which concrete products are well suited.

Home Modernization Market

What is true of the farm market is true, in some measure, of the home building market. Through the HOLC, money is being made available for the repair and remodeling of existing homes. Then, in addition, there are thousands of home owners of the type who have been "in funds" all through the depression, and who are just beginning to loosen up. These two sources will stimulate the modernization of existing homes; and to the concrete products manufacturer that means the construction of recreation rooms in basements, partitions for fruit and vegetable rooms, new garages, new roofs of concrete tile, chimney tops, fence posts, and numerous other items.

This home modernizing market can be developed only through house-to-house calls, coupled with direct mail and local newspaper advertising, and through co-operation with local mason and plumbing contractors. Almost invariably the remodeling of a basement requires changes in wiring and in plumbing and heating pipes, so that the plumbing contractor, the electric wiring contractor, the mason contractor and the products manufacturer all have an interest in developing this field.

Not Overlooking Small Business Buildings

Small business buildings also offer an opportunity for co-operation with mason, plumbing and electric wiring contractors. Many a one-story or two-story business building of Civil War vintage is leaning on its neighbors for support. Such a building can be completely revamped by means of a concrete ashlar veneer to true up the walls, a new suspended ceiling to cover up the old one, colored concrete floor tile to replace a creaky and decayed wooden floor, and a modernized front to replace the shabby old front. In such cases the products manufacturer should bring the local architect into the combination, so that attractive sketches may be prepared for the owner.

All this requires hard work, plus a well-planned selling campaign fitted to your community, and the ability to keep going in the face of discouragement.

Condensed from paper presented before annual meeting of the Wisconsin Concrete Products Association, Milwaukee, Wis., Feb. 9, 1934.

Cement Grout Coatings Prevent Corrosion of Steel Tanks

Methods of Applying Grout to Railway and Municipal Water Supply Tanks—Both Neat and Cement-Sand Mixtures Employed

IN 1918 the Santa Fe Railway experimented with protective coatings of cement grout painted on the inside of steel boiler washing and cold water storage tanks. Sufficient success was achieved to bring about adoption of this treatment quite generally over the system.

The M-K-T Lines also have successfully used neat cement paint coatings on the inside of steel tanks, as told in a report prepared by J. H. Davidson, water engineer, describing the methods used and the results obtained.

About five years ago the American Tank Service Company, of Dallas, Texas, painted the inside of the city water tank at Cleburne, Texas, with a coating of cement and fine sand which was found, on inspection, to be in good condition after nearly four years of service. The American Tank Service Company has since treated successfully a number of water supply tanks.

The Santa Fe's Practice

The Santa Fe Railway has used a mix of one part of cement to one of fine sand, applied with a brush in two coats—the second coat following the first by from four to ten hours. When the work is done from a raft it proceeds downward as the water is drawn from the tank. Ordinarily the use of scaffolding is more practical. The consistency of mix is such as to give it body and as great a thickness of coat as practicable in application with a brush. The "paint" is constantly stirred.

The Santa Fe has also employed a neat cement grout to which was added about 5 per cent of hydrated lime to facilitate application. Some of the engineers of this company prefer to defer painting new tanks for about one year, to allow loosening of mill scale.

Procedure Followed by the M-K-T

The practice followed on the M-K-T Lines consist in applying a neat cement grout in two brush coats about 12 hours apart, and about the same time is allowed after the second coat before placing the tank in service. A small jet of steam is allowed to enter the tank continuously while the cement grout is hardening.

The American Tank Service Company used a neat cement paste paint with a small amount of hydrated lime. That company recommends that the coating be kept wet for 21 days. All agree on the necessity of keeping the coats moist until they harden and the tank is put into service.

Practice of Great Northern

The Great Northern Railway has prepared specifications for painting the interior of steel water tanks with portland cement grout. They use a mix of two parts of cement to one part of sand, all of which passes a No. 16 screen. The specifications require that the tank must be clean, the grout fresh, mixed in small batches, of a consistency of heavy cream and applied with a bristle brush that is kept clear by frequent washings. Two coats are applied, each coat being 1/16 in. thick, and the second following the first after 12 hours. In case the two applications do not produce a coating ⅛ in. thick, a third coat is applied, allowing 12 hours time between the second and third coats. The coats are kept constantly moist from the time of application until water is admitted into the tank. This curing is accomplished by introducing a very small amount of steam into the tank.

It is common experience that the coating adheres almost perfectly when it is constantly submerged. If the coating scales off along the water line or at other points, it is a simple matter to replace it; but when the coatings are properly applied and cured the amount of replacement will be small.

Conclusions

Certain conclusions may be drawn from the above:

(1) Neat cement paste or a grout of cement and fine sand may be made to adhere to the inside of steel water tanks and protect them against corrosion.

(2) Whether a neat cement paste or a cement-sand grout is used is largely a matter of application. The use of fine sand in the mix may tend to reduce shrinkage and therefore preserve the integrity of the coatings.

(3) If the coating is always submerged or always wet, no appreciable shrinkage will occur, but rather the coating will expand and thus make cracks practically impossible.

(4) The use of admixtures that will not materially reduce the strength of the coatings, and hence their bond to the steel, is a matter of facility in application.

Acknowledgments: For the data here given, CONCRETE is indebted to O. T. Rees, assistant engineer of tests, and A. W. Johnston, supervisor of water service, A. T. & S. F. Ry.; to J. H. Davidson, water engineer, Missouri-Kansas-Texas Lines; to H. S. Loeffler, bridge engineer, Great Northern Ry.; to Romer Bullington, of the American Tank Service Co.; and to A. C. Irwin, manager of the railways bureau of the Portland Cement Association.

Books on Concrete

READERS of 'Concrete' are showing a renewed interest in books dealng with concrete design and construction, and with concrete products.

Because of this renewed interest, the Book Departmnt of "Concrete" has nearly trebled the number of books made available to readers. Two full-page lists are now being carried, containing descriptions of nearly thirty books.

List No. 1 includes books on reinforced concrete engineering design. List No. 2 covers concrete construction, concrete making, cement manufacture, concrete products, cast stone, and architectural concrete. Both lists appear in this issue.

The special combination offer at the foot of each list enables readers to obtain books at a considerable saving, through a subscription to "Concrete."

Fifty thousand concrete tetrahedrons produced daily, for use in Mississippi River flood control. Nested steel forms filled twice a day with 'Incor' Concrete from two paving mixers operating in tandem

6¾ Million Concrete Pyramids to Keep Ol' Man River in His Place

'Incor' Cement Enables Contractor to Fill Forms Twice Daily . . . 60% to 80% reduction in curing time lowers costs, assures steadier employment

Interesting both as an engineering problem and as a further demonstration of the operating advantages of high-early-strength cement, is the use of concrete tetrahedrons, by U. S. Army Engineers in Mississippi River flood-control operations below Memphis. These four-plane, triangular-shaped units, 12 inches in height, are dumped from barges at rates determined by laboratory experiment, based on barge speed, river current and water depth. Any face of a tetrahedron is the 'bottom,' so whichever way they fall they stay put, low center of gravity assuring great stability. Space between blocks fills with silt, forming an integral bank-paving to keep Ol' Man River in his proper place.

Contract requiring casting and loading on barges of 50,000 units daily on a total order of 6,780,000, was awarded last November to Simons-Mayrant Company, Charleston, S. C. Forms were designed to permit the use of paving mixers and highway-construction methods. When concrete hardens, the individual steel forms are lifted, turned upside down, and the blocks, released by hammer tap, stored alongside casting bed for curing.

Forms Used Twice Daily

By using 'Incor' 24-Hour Cement, the contractor fills forms twice daily and units are delivered to Government barges in 48 hours or less. Average 48-hour strength of 81 cylinders of 'Incor' concrete used on this job is 3166 pounds per square inch; specifications require 2000 pounds at time of delivery.

'Incor', a *better* Portland Cement, produces service-strong concrete in 24 hours. Sixty to 80 per cent reduction in curing time brings many important advantages in concrete work of all types and kinds. On P.W.A. and C.W.A. jobs, 'Incor' means steadier employment for labor — no lay-offs waiting for concrete to cure. While concrete hardens, someone always loses.

'Incor'* is made by producers of Lone Star Cement, subsidiaries of International Cement Corporation, New York, and sold by leading cement manufacturers.

* Reg. U. S. Pat. Off.

'INCOR' 24-Hour Cement

HOW TO DO IT

◆ Questions and Answers ◆
Consultation and Comment

A department devoted to the solution of problems encountered in concrete work. Readers are welcome to add to or improve upon the suggestions printed and to submit their views for possible publication.

Preventing Cracks in Marble Mosaic Slabs

In the course of our cast stone business we manufacture art marble mosaic slabs having dimensions up to 6 by 4 ft., and usually made 1½ in. thick. Notwithstanding that the slabs are properly reinforced with steel bars and are thoroughly cured, we find that these slabs develop cracks in course of time. We shall, therefore, be obliged if you can suggest a remedy for overcoming these difficulties.—P. H. A., Calcutta, India.

The question raised by this subscriber was referred to J. M. Fuhrman, secretary of the National Terrazzo and Mosaic Association, who in turn obtained the following opinion from a well-known manufacturer:

"In my opinion cracks should not occur in manufactured marble mosaic slabs of this size and thickness if the steel reinforcement is placed close to the bottom of the slab. The inquiry says nothing about warping, but the size of slab mentioned is rather large, and I would be more afraid of warping than of the possibility of developing cracks.

"Many years ago the art marble mosaic trade had a large run of mosaic mantels, before tile took its place, and although the slabs were reinforced we often had trouble in keeping them straight, especially if the subcontractor left them leaning against a wall for a time; but we never had any trouble with cracks. Many of these mantels are still in place, especially in the eastern section of the United States, where the product was widely advertised and popularized.

"The thickness of 1½ in. should be sufficient for slabs of the size under consideration, if manufactured properly and if the entire slab is made in the same day."

Another manufacturer, however, expressed the opinion that slabs as large as 6 by 4 ft. should be at least 2 in. thick, instead of 1½ in.

It might also be suggested that better distribution of steel reinforcement would be obtained if welded wire fabric were used, rather than small steel bars.

●

Concrete "Log Cabin" Design

Can you refer me to manufacturers of metal molds suitable for casting concrete "logs" for buildings of log cabin architecture?—D. M. J., Milwaukee, Wisconsin.

Several concrete products manufacturers have given some attention to the casting of concrete wall sections simulating log cabin architecture. As to manufacturers of metal forms or molds, those given on a list which is being forwarded to you would doubtless give you an estimate on molds made especially for such a purpose.

Concrete "logs" may also be cast in waste molds of plaster, as described on page 46 of the May (1930) issue of CONCRETE. This method was employed some years ago by a builder who brought in from the woods some actual logs of suitable size and appearance and having a length equal to the longest straight stretch of wall. Four or five logs of the same kind of timber were selected, with a view toward some variation in size and appearance in order to avoid undesirable repetition. The wooden logs were then notched and shouldered to fit properly at corners, after which waste molds of plaster were made from them.

When the concrete "logs" were cast, four ½-in. round steel bars were placed in each, as reinforcement. One bar was placed near the bottom of the mold, one near the top, and one on each side. In each case the bar was placed about 1½ in. from the face of the mold. Because of this reinforcement the "logs" could be lifted and handled with any side up, without danger of breaking.

After the actual wooden logs were used for making the waste molds for the longest straight stretch of wall, they were cut down for the next shorter stretch of wall, and the process was repeated. This cutting down in length was, of course, repeated for each shorter stretch of wall.

●

Design and Manufacture of Concrete Poles

Can you refer us to published information on the manufacture of large poles of reinforced concrete?—C. A. P., Montevideo, Uruguay.

For information on manufacturing processes you are referred to a series of two well-illustrated articles published in the November and December (1925) issues of CONCRETE, under the heading of "Concrete Poles Now Widely Utilized."

A 16-page pamphlet on "Design and Manufacture of Concrete Poles" was published in 1926 by the Portland Cement Association, but it is now out of print, though you may be able to consult a copy in the reference library of a cement manufacturing company in your city. This pamphlet was abstracted from several reports of the committee on power distribution of the American Electric Railway Association, presented at the annual meetings of that organization held in 1924 and 1925. In consequence, the full reports may be consulted if you have access to the *Proceedings* of the American Electric Railway Association for those two years.

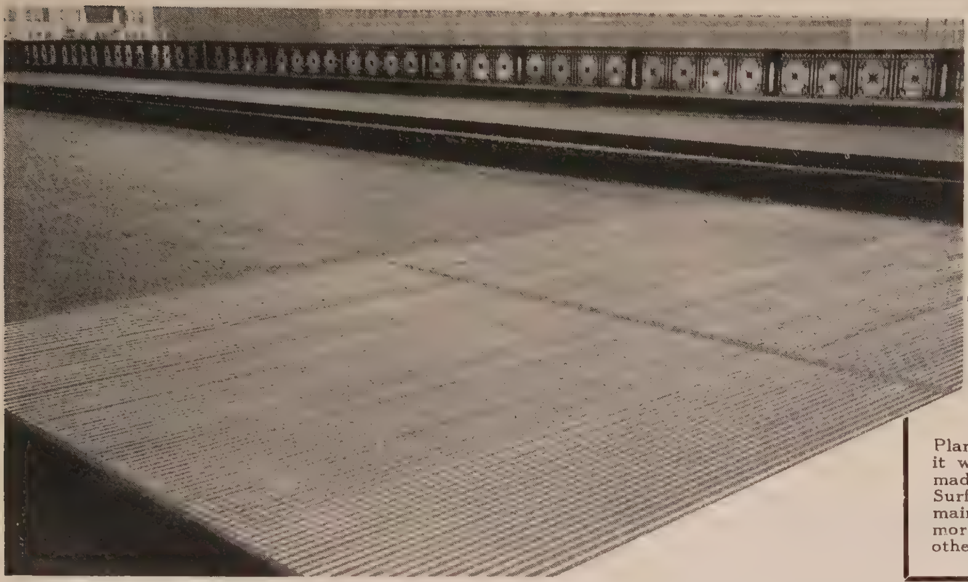
●

Placing Cement Grout Under Pressure

Please wire us names of manufacturers who make equipment for placing cement grout, under pressure, between brick veneer and concrete walls, and for forcing grout into honeycombed concrete in tunnel lining.—H. C. A., Los Angeles, California.

Several manufacturers make equipment that is either designed for the purposes you mention, or which may be adapted to such purposes. These manufacturers have been requested to send you their literature.

SERVICISED EXPANSION JOINTS



SPONGE RUBBER
CORK
FELT SIDED
PLAIN
COMPOSITION

BRIDGE PLANKING PROTECTION COURSE

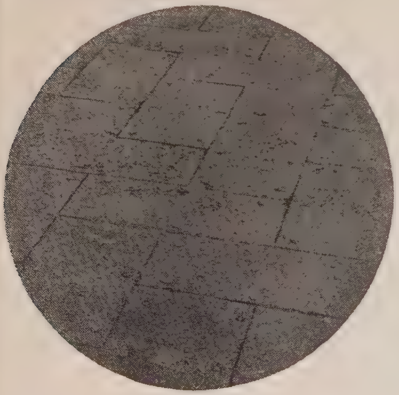
SERVICISED Bridge Planking has now been in use for more than seven years! No SERVICISED Planking has ever been replaced where it was recommended for the job. It is made in Standard, Sementread and Rock Surfaced styles and is in use on the main Chicago bridges where probably more traffic is encountered than on any other thoroughfare.

ASPHALT PLANKING

STANDARD—SEMENTREAD
ROCK SURFACED

SEMENTREAD is a new skid-proof planking—one which can be **guaranteed skid-proof**—when laid horizontal to the traffic it promptly stops the forward motion of the car, and when laid vertical to the traffic it stops the side skid as well as forward skidding. SEMENTREAD comprises a cement rib keyed in the asphalt plank surface, which adds rigidly to the surface also making it skid-proof. This material is especially adapted on city bridges and viaducts where wet days are a menace to traffic and where short skids are dangerous and cause accidents. **Be sure to learn about this product before laying another foot of planking!**

Skid-Proof Your Bridges



Rock Surfaced Planking

ROCK SURFACED planking comprises SERVICISED asphalt planking having imbedded in its surface particles of rock. We do not believe that this is in any measure as skid-proof as SEMENTREAD. It, however, prevents skidding to a greater extent than the plain surfaced asphalt planking.

CENTER ROAD MARKINGS

SEMENTREAD planking in six or eight inch widths is highly adapted for road marking purposes having alternate black and white or black and yellow lines—the lines consisting of Portland cement.

SERVICISED Expansion Joints, whether sponge rubber, cork, felt sided, or plain composition, excel! SERVICISED Expansion Joints have given service over a period of twelve years, and are found in State highway work in every State in the Union which has used Expansion Joint within this period. You will not be doing justice to your organization without securing prices and learning about these products.

Write today for full particulars on SERVICISED Products

SERVICISED PRODUCTS CORPORATION

6051 WEST 65th STREET, CHICAGO

(Continued from page 18)

of hopefulness backed by actual evidence of improvement. Papers and discussions were well presented.

The convention opened with an address of welcome by Councilman Laidlaw, representing Mayor W. J. Stewart, of Toronto, followed by addresses by T. W. Bishop, president of the Concrete Products Association of Canada and by Benjamin Wilk, president of the National Concrete Masonry Association and chairman of the Code Authority.

Dan Servey, of the Haydite Corporation, Kansas City, explained the value and practical use of the book, "Facts About Concrete Masonry," an association publication. D. R. Collins, of the Portland Cement Association, discussed sales methods. "What About the Concrete House?" was presented by Benjamin Wilk, and the writer discussed the meaning of the NRA code, as set forth in the early part of this article.

Explains Chemistry and Fineness of Cement

W. J. D. Reed-Lewis, consulting engineer, Detroit, presented an unusual paper in which he set forth, by means of charts, the chemistry of cement, with particular reference to fineness. Presented in an understandable manner, this paper drew out much discussion, during which several products manufacturers expressed the hope that it might be published in full.

R. E. Copeland's paper on "Tests of Load Capacity of Precast Concrete Joists," presented at the joint session with the American Concrete Institute, also carried an interesting message to manufacturers of concrete products.

While adverse weather conditions, combined with adverse economic conditions, resulted in holding down the attendance figures, the officers of the products associations on both sides of the line have reason to feel encouraged.

Officers Re-elected

The president of the Concrete Products Association of Canada is T. W. Bishop, products manufacturer, Ridgeville, Ontario, and the secretary is Harold W. Thompson, of the Thompson Publications, Toronto. Benjamin Wilk was re-elected as president of the National Concrete Masonry Association; Dan Servey was elected vice-president; Horace W. Bush, 211 Edgemont Place, Teaneck, New Jersey, was elected secretary-treasurer, and D. R. Collins, of the Portland Cement Association, 33 W. Grand Avenue, Chicago, was re-elected as assistant secretary-treasurer.

A. S. T. M. Moves

HEADQUARTERS of the American Society for Testing Materials have been moved from the Engineers' Club Building, 1315 Spruce Street, Philadelphia, to more adequate offices in the Atlantic Building, 260 S. Broad Street in the same city.

San Francisco Traffic Artery Paved with Concrete

THE January (1934) issue of CONCRETE describes and illustrates a metropolitan concrete paving project in Chicago, namely, the extension of Lincoln Park Outer Drive. The December (1933) issue carries a description of Grand Central Parkway, a recently completed concrete paving project in the New York metropolitan district.

As a further indication of the vastness of paving projects of this type—recently completed, under construction, or contemplated—the Pacific Coast offers the Bayshore highway, leading out of the heart of San Francisco and continuing to San Jose, California, a distance of 40 miles.

This 40-ft. traffic artery, of which 5.5 miles remain to be completed, consists of two 20-ft. 11-9-11 thickened-edge sections of concrete pavement.

Bayshore highway, a 40-ft. concrete traffic artery in the San Francisco metropolitan area

BOOKS On Concrete

List No. 1—Reinforced Concrete Engineering Design

(Prices quoted are for cash in advance, and include postage)

GENERAL ENGINEERING HANDBOOK. By Charles Edward O'Rourke and 29 associates. Flexible cover; 921 pages, 5 by 8 in., numerous tables, diagrams, and illustrations. Price **$4.00**

This book assembles a great amount of fundamental engineering data in usable form, 31 separate sections dealing with as many specific branches of engineering. Of particular interest to engineers who specialize in the use of concrete as a structural material are sections devoted to "Highways," by Thomas R. Agg; "Reinforced Concrete Structures," and "Stresses in Framed Structures," by Charles Edward O'Rourke; "Engineering Materials," by Herbert H. Scofield; "Foundations," by Roland P. Davis; and "Mechanics," by Alfred P. Poorman.

REINFORCED CONCRETE CONSTRUCTION. By George A. Hool, Professor of Structural Engineering, University of Wisconsin.

Vol. I—Fundamental Principles. Third Edition. 380 pages, 6x9, 139 illustrations, 18 tables, 28 diagrams **$3.50**

Vol. II—Retaining Walls and Buildings. Second Edition. 700 pages, 6x9, illustrated..........**$6.00**

Vol. III—Bridges and Culverts, 688 pages, 6x9, over 600 illustrations, 41 plates..........**$6.00**

CONCRETE ENGINEERS MANUAL. By Samuel Baker and A. DeGroot. Cloth, 401 pages, 5 by 7½ in., numerous drawings, charts and tables. Price **$3.00**

This volume is intended as a textbook for students of concrete engineering, and as a reference book for designers, foremen, inspectors, and others involved in the design of concrete structures and in the making and placing of concrete. The book contains a complete description of the modern methods of proportioning concrete mixtures, mixing and placing concrete and steel, and providing waterproofing. Mathematical tables and the fundamental principles of mathematics and mechanics of materials, as applied to reinforced concrete designs, are included.

Among other subjects treated in individual chapters are form work, foundations, design of retaining walls, and estimating concrete work.

PRINCIPLES OF REINFORCED CONCRETE CONSTRUCTION. By F. E. Turneaure, Dean of the College of Engineering, University of Wisconsin, and E. R. Maurer, Professor of Mechanics, University of Wisconsin. Fourth Edition. Revised and largely rewritten. 461 pages, 6 by 9. Fully illustrated. Cloth Net **$4.00**

A general textbook on design, including material from actual designs relating to experimental results, and the theory of flat slabs.

CONCRETE ENGINEERS' HANDBOOK. By George A. Hool and Nathan C. Johnson, assisted by S. C. Hollister, and with chapters by Harvey Whipple, Adelbert P. Mills, Walter S. Edge, A. G. Hillberg and Leslie H. Allen. 800 pages, 6 x 9. Illus. Flexible binding. Price **$6.00**

A compact reference book, containing tables, formulae and data on plain reinforced concrete, covering the entire field.

HANDBOOK OF REINFORCED CONCRETE BUILDING DESIGN. By A. R. Lord, Consulting Engineer. 261 pages, 5¼ x 7½, 156 tables and diagrams. Flexible leather. Price **$1.00**

A compact yet comprehensive handbook for the designer of reinforced concrete buildings. The author has presented numerous tables and diagrams developed as time savers during his extensive experience in the design and construction of buildings. Use of diagrams is illustrated with solutions of typical design problems.

CONCRETE PLAIN AND REINFORCED. By the late Frederick W. Taylor, Sanford E. Thompson, and Edward Smulski. Vol. I. Theory and design of Concrete and Reinforced Structures. 969 pages, 6 x 9, 311 figures, 42 tables, 25 diagrams. Vol. II. Theory and Design of Continuous Beams, Frames, Building Frames and Arches, 688 pages, 6x9, 224 figures, 5 tables, 31 diagrams. Cloth. Vol. I, **$8.00**; Vol. II, **$7.50.**

For more than twenty years "Concrete, Plain and Reinforced" has been the recognized standard in its field. Volumes I and II are far more complete than the earlier editions that appeared in single volumes.

REINFORCED CONCRETE AND MASONRY STRUCTURES. By Hool and Kinne. 722 pages, 6 x 9, illustrated. Price **$6.00**

The work of 14 specialists. This book offers a practical and detailed discussion of every important element entering into the design and construction of concrete and masonry structures. Particularly noteworthy are the very thorough treatments of Reinforced Concrete Buildings, Concrete Forms, Chimneys and Concrete Detailing.

REINFORCED CONCRETE DESIGN SIMPLIFIED. By James R. Griffith, Professor of Structural Engineering, Oregon State Agricultural College. This is the fourth printing of a series of 38 full-page simplified design charts based on the design regulations approved by the Joint Committee on Concrete and Reinforced Concrete, and by the American Concrete Institute. As a designers' aid these charts are indispensable. Price **$1.00**

ELEMENTARY GUIDE TO REINFORCED CONCRETE. By Albert Lakeman. Seventh edition, revised 1930; 94 pages, 79 illustrations. Price **$1.25**

This book is written for the builder, the student, the foreman, or anyone not having a previous knowledge of the principles of reinforced concrete design. Individual chapters cover loads and reactions, reinforcement, neutral axis, reinforced concrete beams, bending moments, shearing stress, reinforced concrete columns and walls, concrete bases, and concrete foundations.

REINFORCED CONCRETE DESIGNERS HANDBOOK. By Chas. E. Reynolds. Published in 1932; 300 pages, 40 designing tables, 51 illustrations. Price **$5.00**

This book contains complete data for the design of all classes of reinforced concrete structures, written by an engineer who is familiar with the designing practice of the leading British specialists in reinforced concrete.

REINFORCED CONCRETE WATER TOWERS, BUNKERS, SILOS AND GANTRIES. By W. S. Gray. Published in 1933; 256 pages, 170 illustrations, 2 folders. Price **$4.00**

Written by an author with practical experience, this book supplies the designer much needed information on the design of structures of these unusual types. The book includes many labor-saving diagrams. Other subjects include heat transmission through concrete walls and calculation of stresses due to hot liquids. A large part of the book is devoted to construction methods and cost estimating.

REINFORCED CONCRETE RESERVOIRS AND TANKS. By W. S. Gray. Published in 1931; 200 pages, 119 illustrations. Price **$4.00**

This book deals in a thoroughly practical manner with the design and construction of plain and reinforced concrete reservoirs and tanks and other water-containing structures both above and below ground level, and both covered and open types. Joints in floors and walls are given special attention.

SPECIAL COMBINATION OFFER: $1.50 (or $2.00 for Cement Mill Edition) added to the price of any of the above listed books will entitle you to one years subscription to Concrete or extend your present subscription one year from its present expiration date. Foreign and Canadian subscribers please write for details.

Book Department of CONCRETE, 400 West Madison Street, Chicago, Illinois

NOW
YOU'LL MAKE SOME MONEY

"The Automatic Sealing Vault" is the 100% protection bereaved families will buy even when hard pressed. Now that good times have returned they will buy even more readily. Get into a business of your own and become independent. No shut-downs, no lay offs when you manufacture "The Automatic Sealing Vault." You get a good income from an independent business with no selling problem. All you do is manufacture and deliver.

"The Automatic Sealing Vault" and "The Inverted Air Seal Vault" offer exclusive features that make them sell against all competition. Hundreds of cement products manufacturers have made good livings selling these two outstanding products. Investment is very small—one set of molds makes all sizes of vault. Our free book tells all about it. Write for a copy now.

THE AUTOMATIC SEALING VAULT CO.
334 River Street Peru, Indiana

AUTOMATIC SEAL AND INVERTED AIR SEAL VAULTS

STAR AND ANCHOR COLORS
CLEAR AS THE RAINBOW'S

Color must be free from muddiness—without off-shades—as clear as the colors in a rainbow. Color like that gives you walls and floors that please and attract. Anchor and Star Colors are like that. They please owners and attract buyers.

Architects and contractors have been using Star and Anchor Colors for more than fifty years with perfect satisfaction. When you use them you will find them workable, uniform, pure and most inexpensive. There was no let-down of quality during the depression. On the contrary, every effort is made to improve the quality constantly.

Send for booklet and sample

Associated Companies

C. K. Williams & Co.
644 N. 13th St., Easton, Pa.
88 Kent Ave., Brooklyn, N. Y.
1500 S. Western Ave., Chicago, Ill.

Geo. S. Mepham & Co.
20th & Lynch Ave., East St. Louis, Ill.
107 N. Montgall Ave., Kansas City, Mo.
1500 S. Western Ave., Chicago, Ill.

"Over Half a Century Making Good Colors"

W. C. P. A. Officers Re-elected

OFFICERS of the reorganized Wisconsin Concrete Products Association were re-elected at the annual convention held in Milwaukee on February 8 and 9. The re-elected officers include, for president of the association, Arthur W. Devos, of Wm. H. Devos, Inc., Milwaukee; for first vice-president, Ed Olsen, of the Badger Concrete Co., Oshkosh; for second vice-president, Elmer Leuty, of Beloit; and for secretary-treasurer, L. E. Schwalbe, of the Economy Concrete Products Co., Wauwatosa.

Photo by Milwaukee Journal

Re-elected officers of the Wisconsin Concrete Products Association include (from left to right) Arthur W. Devos, president; L. E. Schwalbe, secretary-treasurer; Elmer Leuty, second vice-president; and Ed Olsen, first vice-president

The annual meeting drew an attendance of more than 100, many of whom came from other states. The annual banquet was attended by 75 delegates and visitors. The Wisconsin state code of fair competition was one of the convention subjects under discussion.

American Standards Association Officers

THE re-election of Howard Coonley to the presidency of the American Standards Association for the year 1934 was announced at the annual meeting of the association in New York on December 13. Mr. Coonley is the president of the Walworth Company, New York, and also a director of several industrial, insurance, and banking organizations. F. E. Moskovics, chairman of the board of the Marmon-Herrington Company of Indianapolis, and vice-president of the American Standards Association, was also re-elected for the coming year.

A. C. Irwin, representing the American Railway Association, and F. M. Farmer, representing the American Society for Testing Materials, were elected to the chairmanship and vice-chairmanship, respectively, of the Standards Council of the American Standards Association, the body in charge of the development of technical standards.

Coming Conventions

March 4-11—**Leipzig Trade Fair, Leipzig, Germany. 1934 Spring Fair with Exhibits. Leipzig Trade Fair, Inc., 10 E. 40th St., New York City.**

March 5-9—**American Society for Testing Materials. 1934 Group Meetings of Committees. Wardman Park, Hotel, Washington, D. C.**

March 7—**American Society for Testing Materials. 1934 Regional Meeting. Wardman Park Hotel, Washington, D. C.**

March 13-14—**American Railway Engineering Association. Annual Meeting, Palmer House, Chicago. E. H. Fritch, Secy., 59 E. Van Buren St., Chicago, Ill.**

March 14-15—**Concrete Reinforcing Steel Institute. Annual Meeting, Edgewater Beach Hotel, Chicago. R. W. Johnson, Secy., 333 North Michigan Ave., Chicago, Ill.**

June 25-29—**American Society for Testing Materials. Annual. Chalfonte-Haddon Hall, Atlantic City, N. J.**

PERSONAL

Odd Albert of the Opla Company, structural engineers of East Orange, New Jersey, has been appointed faculty lecturer on "Advanced Design of Structures" at New York University for the third year.

From the Patent Office

By J. KAPLAN
Patent Attorney, Washington, D. C.

Glossy colored concrete surface: Florus Bierling, Leipzig, Germany. U. S. Pat. 1,916,034.—To the facing mixture for the concrete unit a solution containing hydrochloric acid is added. The facing mixture is then placed into the mold, and the body concrete is added.

●

Coating concrete silo blocks: Walter O. Brassert, Kalamazoo, Mich. U. S. Pat. 1,920,627, Aug. 1, 1933.—Precast concrete silo units are acidproofed against ensilage acids and moisture, by heating one face of the unit to remove moisture, then partially immersing the unit in molten paraffin or asphalt to coat and impregnate the heated face.

●

Stone-faced concrete block: Michael A. Grieco and Raymond Johnson, Chicago, Ill. U. S. Pat. 1,916,308, July 4, 1933.—Reinforced concrete blocks during manufacture have small natural stones embedded in the outer face. The outer face consists of a ½-in. layer of waterproofed composition, colored to suit particular needs.

●

Wall construction: Charles W. Duncan, Sausalito, California. U. S. Pat. 1,914,770, June 20, 1933.—This wall construction consists of two interspaced walls of cellular blocks, held in position by invisible clips. The space between the two wall sections is filled with a cementitious filler material, which adheres to the block surfaces and forms a substantially monolithic wall.

●

Building block: Ira E. Cramer, Beaumont, Texas. U. S. Pat. 1,915,051, June 20, 1933.—Building blocks are made of a mixture of 1 part of portland cement and petroleum coke fines and 3 parts of petroleum coke lumps.

●

Protecting and curing freshly-placed concrete: Lester N. Weber, Chicago, Illinois. U. S. Pat. 1,841,931.—Freshly-placed concrete floors are protected and cured with sheets of waterproof paper, with edges overlapping and secured with a moisture-proof adhesive. This covering prevents the premature drying of the concrete.

To insure *all* the advantages of using plywood forms . . .

Two years of full tests and experience with fir plywood panels glued with Lauxein 1001 Waterproof Glue has thoroughly demonstrated that they will withstand the unusually severe tests of concrete construction work . . . the moisture, the exposure, the bending, and the general rough and repeated usage.

Contractors look for and recognize this superior glue by the brilliant spangled glue-line panel edges. It is known to the trade as

"1001 Waterproof Glue"

Contractors who specify fir plywood with "1001 Waterproof Glue" are getting the maximum profits and advantages that the use of these modern forms offer: (1) The 40% to 75% carpentry saving—(2) Increased speed—(3) Smooth, finless surfaces, almost no patching or rub-down expense, no discoloration—(4) Forms are splitproof, non-bulging, ideal for reverse molds—(5) Large sizes reduce lineal footage of joints (stock sizes up to 3 x 8 ft., larger sizes on order).

On hundreds of important new structures—buildings, bridges, dams, viaducts, reservoirs, etc., modern contractors have used fir plywood with Laucks' "1001 Waterproof Glue" and have made big savings.

When ordering fir plywood for concrete forms specify branded plywood with Lauxein 1001 Waterproof Glue.

Send for sample mill run panel for making any test of the glue-line quality

LAUXEIN
LAUCKS
WATERPROOF
GLUE
PATENTED
TRADE MARK REG. U. S. PATENT OFFICE

I. F. LAUCKS, Inc.
Manufacturers of Lauxein Glues
Seattle, Washington

ONLY $180.00

f. o. b. Columbus, buys

10,000 GAL., 2" "SURE-PRIME" CENTRIFUGAL

(WITH STRAINER ONLY $165)

This rugged, powerful, little pump handles more water and serves more jobs for you, single handed or in tandem or multiple. Performs at lifts and heads where many pumps quit. Larger sizes at similar low prices. Write us for new catalog, just out.

THE JAEGER MACHINE CO.
522 Dublin Ave., Columbus, Ohio

OTHER JAEGER "SURE PRIME" PUMPS 3"—4"—6" SIZES

TIMKEN BEARINGS
BIG 2½ H. P. ENGINE

BESSER

Plain Pallet Strippers pay for themselves in first cost and in operating cost as they make an endless variety of concrete units upon a single set of inexpensive plain Pallets. Now available at any price and capacity desired and with improved features.

Complete sales and service on BESSER, ANCHOR, CONSOLIDATED, IDEAL, HOBBS, UNIVERSAL

Complete equipment for concrete products plants

BESSER MANUFACTURING COMPANY
203 34th Street Alpena, Michigan

Ask us about attachment for making the new oscillated waterproof cinder units

I'VE FOUND THE BEST HOTEL VALUE IN NEW YORK CITY.

Just think... a modern, new hotel, in the heart of New York—200 feet from Broadway, on 45th Street. A room and bath for one, $2.50; for two, $3.50.

It's the PICCADILLY

45th STREET and BROADWAY • NEW YORK
WILLIAM MADLUNG, Mng. Dir.

If you haven't found what you are looking for in these advertising pages, drop us a postcard and we will see that you get the information you want. There is no charge for this service.

CONCRETE
400 W. Madison St. Chicago, Ill.

Equipment and Materials

TWO new types of trucks, designed especially to meet length and weight restrictions imposed by statute in different states without sacrificing pay-load capacity, have been introduced in the new line of 1934 General Motors trucks. They are "cab-over-engine" models and "set-back front axle" models.

Both new types are shorter than trucks of conventional design for any given pay load capacity. The reduced length also provides increased facility of operation in congested city traffic. Wheel-base and turning radius are reduced, and less garage space is required.

The cab-over-engine models carry 67 per cent of the load on the rear axle, and the set-back axle trucks carry 70 per cent, thus placing more load on the front axle, which gives more efficient tire and axle loading, they say.

The cab-over-engine model has no hood, the front of the cab being nearly flush with the front end of the chassis. The engine is mounted in a "wind-tunnel" that extends back from the radiator grille. Engine heat is swept through this conduit and discharged downward. Insulation in the walls of the tunnel prevent heating the cab, which is also provided with a controlled ventilating system.

The engine is mounted on a sub-frame on rollers, permitting its removal for major service through the "front-door" radiator grille construction. For ordinary maintenance and service work, the engine cover in the cab may be removed for access to the ignition units, valves, carburetor, etc.

Improved appearance, comfort cabs and greater braking capacity are claimed in the 1934 models.

•

FLEXICORE, a new method in the construction of sewers, culverts, drainage systems, buildings, poles and posts, is said to have many advantages. The core makes possible monolithic construction even though short radius bends are required.

The necesity for constructing ducts or other circular openings in concrete without joints, special shapes, etc., led to the invention of this core, they say, essentially a rubber hose which expands laterally and contracts longitudinally under pressure. Patent claims were allowed late in 1933 and this form is now being marketed.

It consists of a rubber tube in which is embedded layers of cords which, due to their position, permit the core to expand approximately 30 per cent and shorten in length approximately 15 per cent when under pressure as low as 20 lb. per sq. in. for the larger sizes. The core is furnished in sizes from 1 in. to 24 in. in diameter, with end fittings for air or water pressure. It is leased or rented by the Flexicore Company, Wichita, Kansas, on a basis of lineal feet of duct or conduit constructed by this method.

•

RITECURE, a milky-white liquid with a viscosity said to be only slightly greater than water, is offered by the Johnson-March Corporation of New York City as a curing medium that is transparent for sidewalks, bridges, structures and concrete products. When sprayed on the green concrete, it has the appearance of white paint. The color, they say, starts to dissipate within ten or fifteen minutes and disappears entirely within a few hours, leaving the surface of the concrete covered with a transparent, flexible membrane or film that is impervious to water and not affected by the action of the elements.

In the case of pavement slab, the film is said to gradually wear off under the grinding of automobile tires. It is claimed to give protection to the green concrete by preventing the evaporation of the mixing water, but leaves the surface of the concrete in its original condition, color and texture.

Equipment and Materials

AIR-LOCK expansion joints for concrete paving is a new item. The manufacturers, the W. S. Godwin Co., Inc., of Baltimore, say that these expansion joint forms are strongly formed from sheet steel in lengths and heights and with triangular shoes for thickened edges required by different paving specifications.

Air spaces are provided by means of inserted strips of collapsible water-proofed material, held in place by clips stamped from the sheet steel. Complete sections are coated with asphaltic paint. Sections are held on the sub-grade with heavy steel stakes. The joint, they say, acts as a form while the concrete is setting, but has no function whatever after the tongue and groove joint is formed in the concrete.

◆ Industrial Literature ◆

"STEEL Products for Concrete Road Construction" is the title of Catalog No. 9, distributed by the Highway Steel Products Company of Chicago Heights, Illinois, manufacturers of metal expansion joints, transverse contraction joints, longitudinal contraction joints, "hiway" resilient guard rail fence, metal ditch checks, installing equipment and miscellaneous accessories.

Another booklet covers Translode expansion and contraction joints for concrete pavements which the company is licensed to manufacture under the Translode Joint Company patents.

●

BERG concrete surfacers, attachments and accessories, for surfacing, cleaning, polishing, brush hammering, channeling and drilling concrete buildings, bridges, walls, floors, dams, etc., are fully described in literature being distributed by the Concrete Surfacing Machinery Company, Cincinnati.

●

COLT'S Clamps—Catalog No. 52—has recently been published by the *Batavia Clamp Co., Inc.*, Batavia, N. Y. These clamps are made of malleable iron and steel for use in cast stone and concrete products plants for holding molds, forms and curbing. There are many sizes and styles, eccentric or screw.

Among the Manufacturers

Fred Burggraf, formerly a research engineer and who has recently been making stabilization surveys of Missouri, Minnesota, Wisconsin and other states, has been added to the staff of the Calcium Chloride Association as a recognized specialist in the science of soil stabilization and the development of low-cost roads through stabilization and the incorporation of calcium chloride as a binder in the road surface.

●

C. R. Messinger, chairman of the board of Chain Belt Company, Milwaukee, has resumed the post of president of the company, left vacant by the sudden death of his brother, *Clifford F. Messinger*, in December. For the past three years Mr. Messinger has been president of the Oliver Farm Equipment Company and was recently elected Chairman of the Oliver Board.

●

G. K. Viall, a vice president, was elected to the vacancy on the Chain Belt Board, created by the death of Clifford F. Messinger. He has been with the company since 1921, serving successively as assistant to president, works manager, and vice president.

●

B. C. Tiney, formerly maintenance engineer of the Michigan State Highway Department, and who is chairman of the Maintenance Committee of the Highway Research Board, has been named as chief engineer of the Calcium Chloride Association.

JAEGER 10S -- HANDLES LIKE A 7S

Fastest, easiest to handle 2 bagger, all-steel, short coupled, with knuckle steering, roller bearing wheels. Water Regulator meets all state requirements.

GET OUR LOW PRICES

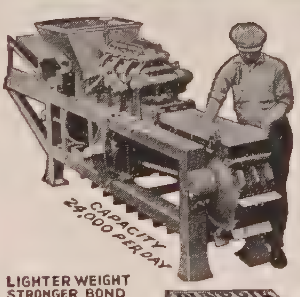
Tilting, non-tilting Mixers, Contractors Pumps, Placing Equipment. Send for catalog.

The JAEGER MACHINE Co.
522 Dublin Avenue Columbus, Ohio

SPECIFIED

for over 45 years by the leading architects and engineers, and used extensively in some of the largest concrete construction work in the country. That is the record of

GIANT PORTLAND CEMENT COMPANY
Pennsylvania Building
Philadelphia, Pa.
370 Lexington Ave.
New York



1934 EARNING POWER

GET SET FOR BIG THREE BILLION DOLLAR PUBLIC BUILDING PROGRAM

A revolutionary process—Makes both face and common brick of highest grade at lowest cost—Used in the finest and largest buildings wherever made—Established plants prove Stability, earning power and point the way to your success.

United Cement Products Company of Wichita supplies both face and common units for large group Sinclair Oil Stations. Bayer & Brice of Flint fill order for over half million DUNBRIK for brewery. Kalamazoo firm sells at 100% mark-up with orders exceeding a million units in one month.

Learn about the earnng power of this business—Why DUNBRIK can be made for less. How it cuts building costs, and how you can secure exclusive franchise—Send for complete Manufacturing Data now.

LIGHTER WEIGHT
STRONGER BOND
BIG SAVINGS IN CONSTRUCTION

W. E. DUNN MFG. CO.
453 W. 24th St. Holland, Mich.

ECONOMY DOUBLE HEADED NAIL

Invaluable for concrete form work. You can drive them home and they hold much more tightly than the ordinary nail. Nails can be withdrawn and lumber and nails used over many times. Hold fast but pull easily. Let us send you half dozen nails to try out with your own hammer. Just drop a line to—

THE F. A. NEIDER CO., Inc.
Augusta, Kentucky

BOOKS On Concrete

List No. 2—Concrete Construction, Concrete Making, Cement Manufacture, Concrete Products, Cast Stone and Architectural Concrete

(Prices quoted are for cash in advance, and include postage)

DESIGN AND CONSTRUCTION OF FORM WORK FOR CONCRETE STRUCTURES. By A. E. Wynn. 320 pages, 219 ills., 12 folded inserts and 11 design tables. Cloth bound, stamped title in gold. Price **$6.00**

"Wynn's Book" is a phrase commonly known to engineers, designers, and foremen, and is heard wherever concrete construction is under way. This book covers every phase of forms for concrete construction, and is fully supplemented with many illustrations, tables and drawings and printed on a superior grade of enameled paper.

CONCRETE CONSTRUCTION MADE EASY. By Leslie Turner and Albert Lakeman. 113 pages, 65 illustrations, 16 tables. Cloth bound. Price **$2.00**

A practical book that solves problems in the design and erection of any type of concrete structure. Full designs with tables and all necessary information for building of foundations, walls, columns, floors, roofs, staircases, beams, water tanks, retaining walls, lintels, formwork, saw-tooth roofs, etc. Written clearly and plainly.

CONCRETE WORK. By W. K. Hatt and W. C. Voss. Size 5¼ by 8. Illustrated. Cloth bound. Price, Vol. I, **$4.00;** Vol. II, **$2.00.**

A practical book for the contractor and engineer. All phases of concrete building erection are covered.

CONCRETE FORM WORK. By A. B. MacMillan, Chief Engineer, Aberthaw Company; 64 pages, 63 illustrations, stiff paper cover. Price **$1.00**

This book is a reprint of articles printed in CONCRETE throughout 1930. Contains complete details and explanations of concrete form work in all parts of concrete building construction. An appendix describes form work for architectural concrete.

ESTIMATING AND COST KEEPING FOR CONCRETE STRUCTURES. By A. E. Wynn. Published in 1930; 272 pages, 92 illustrations, 2 folders. Price **$5.00**

The author of this book has had a wide experience in contracting for all kinds of concrete structures, and in this volume he publishes his own simple methods of estimating, cost-keeping and book-keeping. Reproductions are given of all blank forms required.

PRACTICAL CONCRETE, comprising Vol. I of a series on "Concrete Engineering." By J. Singleton-Green, Consulting Engineer. Published in 1933; 258 pages; tables, diagrams and illustrations. Price **$3.00**

This book describes in simple language the materials for concrete, designing the mix, and the making, placing and curing of concrete. Individual chapter headings cover normal and special cements, types and analyses of aggregates, admixtures, water and impurities, designing concrete, proportions, mixing, placing and curing. Later volumes will deal with properties of concrete, special cements, etc.

BASIC PRINCIPLES OF CONCRETE MAKING. By Franklin R. McMillan, Director of Research, Portland Cement Association. Ninety-nine pages, 6x9½, 32 illustrations and tables. Price **$2.00**

The author has culled the essentials out of a mass of scientific data on this subject and presents them with force and directness in this book. He shows the effects of quality of material, of proportioning, mixing, working and curing on the finished concrete.

The importance of variable mixes; tests for permeability; how to obtain strength, durability and watertightness; effective ratios; importance of proper construction methods—these and many other vital topics are discussed fully and authoritatively.

PLAIN CONCRETE. By Edward E. Bauer, Civil Engineering Instructor, Univ. of Illinois. 346 pages, 6x9, Illus. Price **$4.00**

A complete discussion of cement, aggregates and concrete, covering every detail of production from the selection and preparation of the raw materials to the final sampling and testing. Includes chapters on standard cements, special cements, mineral aggregates, mixing water and admixtures, proportioning, placing, finishing and curing, field control, workability and waterproofness, estimating quantities of materials; also specifications, sampling, testing, etc.

CEMENT CHEMISTRY IN THEORY AND PRACTICE. By Prof. Dr. Hans Kuhl, Director of the Institute for Cement Research, Berlin. Translated into English by J. W. Christelow, B.Sc. 64 pages, 6 by 9, cloth cover. Illustrated with a number of halftones and diagrams. Price **$2.50**

An authoritative book on the chemistry of cement, a translation of a series of lectures delivered by Dr. Kuhl in Moscow, at the special request of the Soviet government. The author presents the most up-to-date knowledge of the subject in simple language. The result is a concise record of modern research on the manufacture and setting of cement. Chapter headings are: (1.) The Development of Cement Research; (2.) The Theory of Cement Burning; (3.) The Constitution of Portland Cement Clinker; (4.) The Problem of Hardening and Its Significance in Cement Research; (5) The Chemistry of High-Strength Cements; and (6.) The Technical Aspect of High-Strength Cements.

STANDARD CONSTRUCTION METHODS. By G. Underwood. 408 pages, 330 illustrations. Price **$5.00**

A complete, detailed presentation of actual methods used in practical construction work. A book packed from cover to cover with plans, short-cuts and expedients for construction superintendents and other men upon whom rests the responsibility of getting jobs done quickly and well.

MANUFACTURE AND USES OF CONCRETE PRODUCTS AND CAST STONE. By H. L. Childe. 354 pages. 265 illustrations. Color plates. Photographs. Completely rewritten and enlarged. Price **$3.00**

Deals with problems of how to use dry mixes for architectural concrete; minimize crazing and efflorescence; design all kinds of molds; select materials; grade and proportion aggregates, regulate mixing, and govern curing; use color in concrete; manufacture columns, cornice posts, curb, blocks and slabs, brick, roofing tile, steps, sills, lintels and edgings, balustrades, sundials, bird-baths, lettered panels, ornamental work, etc. This 1930 edition simplifies every phase of manufacture of concrete products and cast stone of every description for every purpose.

PRE-CAST CONCRETE FACTORY OPERATION AND MANAGEMENT. By H. L. Childe. 216 pages, 5¼x9, illustrations and layouts. Price **$2.00**

Complete description of the plant layouts, equipment, methods and processes of 20 English manufacturers, large and small. Includes the whole range of pre-cast units from the largest cast stone and roofing tile and plain block plants to the small producers of miscellaneous products.

MAKING PRE-CAST CONCRETE FOR PROFIT: A SYSTEM OF COST-KEEPING AND DETERMINING PROFITS. Published in 1930; 56 pages. Price **$1.75**

A method of keeping costs sufficiently accurate for all practical purposes need not be complicated nor require much time. The system described in this book is simple and easily understood, and can be used by anyone not having a technical knowledge of bookkeeping.

MOLDS FOR CAST STONE AND PRE-CAST CONCRETE. By F. Burren and G. R. Gregory. Heavy board cover, 79 pages, 11 by 7½ in.; 44 full-page illus. Price **$1.25**

Detailed working drawings for the practical mold maker, covering a wide range of concrete and cast stone products. Drawings supply the necessary information, and brief descriptions are given in each case.

A lot of good information for cast stone manufacturers, and for makers of special products ordinary concrete, such as fence posts, chimney caps and pots, well lining, laundry tubs, etc.

CONCRETE MONUMENTS, MAUSOLEUMS AND BURIAL VAULTS. By A. A. Houghton. 65 pages, illustrated. Paper bound. Price **$0.75**

The molding of concrete monuments to imitate the most expensive cut stone is explained in this treatise, with working drawings of easily built molds. Cutting of inscription and designs is also fully treated.

SPECIAL COMBINATION OFFER: $1.50 (or $2.00 for Cement Mill Edition) added to the price of any of the above listed books will entitle you to one years subscription to Concrete or extend your present subscription one year from its present expiration date. Foreign and Canadian subscribers please write for details.

Book Department of CONCRETE, 400 West Madison Street, Chicago, Illinois

New Books and Pamphlets

Concrete Work in Refuges for Waterfowl

SMALL REFUGES FOR WATERFOWL is the title of a comprehensive and well-illustrated 64-page booklet issued in January by More Game Birds in America, Inc., 500 Fifth Avenue, New York.

Small concrete dams, concrete bulkheads and other concrete construction will in many cases be needed in the establishment of refuges for wild life, a form of development particularly adapted to CWA work. Concrete contractors should have copies of this book, as aids in the promotion of such projects in their communities.

The booklet describes a number of existing refuges maintained by municipalities, states and private individuals. Copies may be obtained on request.

●

A. S. T. M. Proceedings for 1933

PROCEEDINGS OF THE AMERICAN SOCIETY FOR TESTING MATERIALS, 1933. Published in two parts or volumes by the American Society for Testing Materials, 260 South Broad Street, Philadelphia. Price, each part, is $7.00 in half-leather binding, $6.00 in cloth, and $5.50 in paper binding.

Part I, with 1,092 pages, contains the annual reports of forty standing committees of the A. S. T. M., as well as reports of research and sectional committees. Seven extensive technical papers are included with these reports.

Part II, consisting of 804 pages, contains all the technical papers presented at the annual meeting of 1933, together with oral and written discussions. Complete subject and author indexes are given.

●

Creating Water Areas

WATER AREAS: HOW TO CREATE AND MAINTAIN THEM, is the name of a 22-page illustrated booklet issued in January, 1934, by More Game Birds in America, Inc., 500 Fifth Avenue, New York. A considerable amount of concrete work will be involved in the development of water areas, in the construction of dams, bulkheads, and miscellaneous construction. The plan to provide for the increase of game birds is being supported by the U. S. Department of Agriculture.

●

Heat of Hardening

TEMPERATURE RISE IN HYDRATING CONCRETE, is the title of a 70-page paper-covered bulletin issued in January, 1934, as Technical Paper No. 15 by the Department of Scientific and Industrial Research (London). The bulletin analyzes recent research work on this subject, mainly that conducted in the United States. Copies of Technical Paper No. 15 may be obtained at 1s 3d net, from His Majesty's Stationery Office, Adastral House, Kingsway, London, W. C. 2, England.

●

Mesh-Reinforced Concrete Pavements

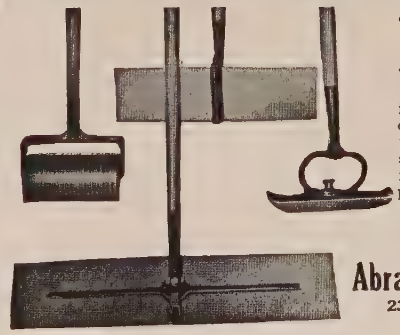
COMPARATIVE BEHAVIOR OF PLAIN AND MESH-REINFORCED PAVEMENTS UNDER TRAFFIC TEST is the name of a 12-page pamphlet issued in January, 1934, by the Wire Reinforcement Institute, Washington, D. C. The pamphlet comprises a review of the results of the "Bates Road Test," conducted some years ago by the Division of Highways, State of Illinois, in which several test sections were reinforced with wire mesh.

Professional Service

E. L. CONWELL & CO.
Established 1894
ENGINEERS -:- CHEMISTS -:- INSPECTORS
Cement, Chemical and Physical Laboratories
Tests of Cement, Concrete, Sand, Steel, Cement Block, Cement Brick.
Chemical Analyses of all Commercial Products.
Complete Technical Supervision of Central Mixed Concrete Plants.
2024 ARCH ST. PHILADELPHIA, PA.

J. KAPLAN
PATENT ATTORNEY
Washington Loan & Trust Building
Washington, D. C.
U. S. and Foreign Patents—Trade-Marks
Agents in all Foreign Countries

Specialties



ABRAM DOUBLE ACTION FINISHING TOOLS

"They put a man on his feet"

The Abram long handled, double action finishing tools—meet the demands of the contractor. They are designed for long service and are moderately priced.

Get our prices—a post card will bring you the details—write today.

Abram Cement Tool Co.
2300 Michigan Ave.
Detroit, Mich.

Liner Advertisements

Rates for these liners: Five cents per word per insertion, cash in advance, minimum one dollar. Copy can be accepted as late as the 24th of any month preceding the date of issue.

For Sale

MANHOLE—CATCH BASIN BLOCK MACHINES
a real proposition for profit. Rebuilt and used machinery including tampers, mixers, brick machines, hand and power operated. Write for details and prices.
H. W. LACKEY
858 East 39th St. Chicago, Ill.

FOR SALE—Hydraulic Stone Machinery outfit automatically controlled, used only a short time. Makes building blocks, trim stone, faced with granite, marble or colors. This outfit is a complete factory equipment costing $12,000 new, will sell at a great bargain, small down payment; will send engineer for ten days to superintend the installation and instruct in operating. Address Box F1, c/o CONCRETE.

FOR SALE—Used Equipment at bargain prices: 25 Standard Block Cars. 20 Folding Deck Block Cars. 50 Four Deck Lift Truck Racks. Address Box G-2, care CONCRETE.

VIBRATED CONCRETE

BY BRANFORD EQUIPMENT

BRANFORD MOULD VIBRATOR *(above).*
BRANFORD TABLE VIBRATORS.
BRANFORD VIBRATOR SPADES *(for concrete in building forms).*
BRANFORD DOUBLE ATTACHING HEAD VIBRATORS *(for application by customer).*
BRANFORD CONCRETE PIPE VIBRATOR *(for metal forms).*
PNEUMATIC VIBRATORS *for Concrete of High Frequency to Suit Any Special Purposes.*

Address Dept. 46

Malleable Iron Fittings Company
Branford, Conn., U. S. A.

WORKABILITY

Without Additional Water

Obtained by using

BARNSDALL ADMIX

(Meta-Colloidal Tripoli Silica)

A Low Water-Factor Admixture of High Purity

97½% Silicon Dioxide

Let us quote on your next job

Barnsdall Tripoli Company
Former Name American Tripoli Company, Inc. 1892
SUBSIDIARY OF BARNSDALL CORPORATION
Seneca, Mo., U. S. A.
Dealers and Stocks in Principal Cities

"Be Square" Products (Reg. U. S. Pat. Off.)

Advertisers' Index

Abram Cement Tool Co. 31
American Steel & Wire Co. Inside Front Cover
Anchor Division of Consolidated Concrete Machinery Corp. 28
Automatic Sealing Vault Co. 26

Barnsdall Tripoli Co. 31
Besser Manufacturing Co. 28
Books 25-28-30
Brookmire, Inc.

Classified Liners 31
Colorcrete Industries 29
Consolidated Concrete Machinery Corp. 28
Conwell, E. L., Co. 31

Dunn, W. E., Mfg. Co. 29

General Motors Truck Co. Back Cover
Giant Portland Cement Co. 29

Ideal Division of Consolidated Concrete Machinery Corp. 28
International Cement Corp. 21

Jaeger Machine Co. 28-29

Kaplan, J. 31

Lackey, H. W. 31
Laucks, Inc., I. F. 27
Lone Star Cement Co. 21

Malleable Iron Fittings Co. 32
Mepham, Geo. S., & Co. 26

Neider, F. A., Co., The 29

Piccadilly Hotel 28
Portland Cement Association 2
Professional Service 31

Servicised Products Corp. 23

Universal Division of Consolidated Concrete Machinery Corp. 28

Williams, C. K., Co. 26
Williamsport Wire Rope Co. Inside Back Cover

Vol. XLII
No. 3

Cement Mill Section of
Concrete

MARCH
1934

New Cements—Their Manufacture, Use and Classification

Use of Accelerators and Improving Agents in Manufacture of Cement by New Processes Causes More Complete Combination—A. S. T. M. Committee Studies New Types

By ALTON J. BLANK
General Superintendent and Supervising Chemist, Compania de Cemento Portland "Landa," S. A.,[1] Puebla, Puebla, Mexico

As has been explained in previous articles[2] covering the manufacture of new cements under United States Patent 1,912,883, lime is hydrated in the presence of siliceous and argillaceous materials and ground under conditions involving controlled moisture, temperature, time limit and fineness conditions to produce masonry cements, cements equal to the standard portland, and cements of the "super" and special types for all-purpose use.

Controlling the Types of Cement

During the hydration and grinding procedures, reactions occur between the lime and the silica and alumina, forming new compounds that result in products having strength and setting properties. Variation in the kinds of materials used, in the proportioning of the same, as well as in the factors of moisture, heat, time limit and fineness of grinding during the process procedure, results in a variety of products. Thus plastic cements; cements having a low heat of hardening; cements especially resistant to alkali ground waters and to sea water; cements having great durability; quick and slow setting cements; high-early-strength cements; masonry, plastering and stuccoing cements; in fact, all-purpose cements, are available.

With certain materials it is found advisable to use certain amounts of portland cement clinker, this being added to the hydrated mixture previous to the grinding procedure of the process. This clinker is found to have an energizing effect, and to result in the formation of new and desired compounds.

It has been found that all siliceous or argillaceous materials do not have the same affinity for reaction with lime during the hydration and consequent grinding procedures of the process. Finely divided materials of the amorphous type, such as diatomaceous earth, are found to react more readily with the lime to form the desired compounds than do certain clays, shales, quartz, and the like. Bringing these materials to a finely divided stage results in their reacting more easily with the lime. Though desirable, complete combination of the ingredients is not involved.

Accelerating Agents Cause More Complete Combination

For the purpose of effecting more complete combination of the silica and alumina with the lime, the use of accelerating, or improving agents, was found desirable. That these desirable reactions were furthered, was definitely established in a great number of mill tests carried out in connection with the preliminary process, the results of which formed the basis for the second United States patent recently issued under Serial No. 644,083.

Accelerating or improving agents that have been found to improve the products of this process include ordinary salt, calcium chloride, sodium hydrate, sodium carbonate, tannic acid, etc.

For example, a 1-per cent solution of sodium chloride is used as the mixing water for hydrating the lime component of the mixture in the presence of siliceous or argillaceous materials, and the resulting mixture is ground under controlled conditions involving moisture, heat, time limit and fineness. If desired, all or a part of the agent may be added after the hydrating step and during the final grinding and mixing stage, with similar results. Thus, insoluble siliceous and aluminous components of the mixture are readily attacked and made more available for combination with the lime, and at a higher heat during the reaction stages. Combinations are naturally effected with certain of the less active clays, etc., when no accelerating agents are used; but these reactions are quickened and more complete when accelerating agents are employed.

Therefore the use of accelerating or improving agents, while not necessary in connection with the use of the more active types of siliceous and argillaceous materials, is found desirable with the less active types of clays, shales, quartz, and others that have a low affinity for combination with lime. This opens up a further and broader field for the raw siliceous and argillaceous materials that may be used in the manufacture of new cements under the process in question.

---

[1] Also Director of Research, Cement Process Corporation.

[2] See *Cement Mill Edition* of Concrete for July, September and December, 1933, and February, 1934, and *Rock Products*, August 25, 1933.

Tests Demonstrate Value of Accelerating Agents

Below is shown a normal mill test whereby lime is hydrated in the presence of tripoli with ordinary water, and with a 1-per cent sodium chloride solution, and the mixture is ground in the mill under normal controlled conditions of moisture, heat and fineness, to yield (1) a normal product, and (2) an accelerated product.

1:3 Sand Briquettes tested at age indicated	(1) Normal Water used for Hydration. Lb. per sq. in.	(2) 1% Sodium Chloride Solution for hydration. Lb. per sq. in.
24 hours	26	43
7 days	32	54
28 days	57	232
3 months	302	397

A second example whereby lime is hydrated in the presence of quarry clay with ordinary water, and with a 1-per cent solution of calcium chloride, and the mixture is ground in the mill under normal controlled conditions of moisture, heat and fineness to yield (1) a normal product, and (2) an accelerated product.

1:3 Sand Briquettes tested at age indicated	(1) Normal Water used for Hydration. Lb. per sq. in.	(2) 1% Calcium Chloride Solution for hydration. Lb. per sq. in.
24 hours	37	50
7 days	79	216
28 days	141	269
3 months	312	397
6 months	389	492

Similar results were obtained through the use of other accelerating or improving agents with various kinds of siliceous and argillaceous materials.

In those products containing portland cement clinker a decided improvement in strength was also obtained, which suggests that the use of accelerating agents in connection with products that contain portland cement results in reactions of a new nature that are being obtained during the final grinding stage of the process.

Accelerating agents are found not only to promote reactions more quickly during the hydrating and grinding procedures, giving greater strength to the products, but certain of the agents are found to promote quick setting properties and other desirable objects.

A. S. T. M. Takes Up New Cements

Considerable has been said and written on the subject of new cements, and the need for them, during the past few months. A new committee has been formed on the regular Committee C-1 on Cement, of the American Society for Testing Materials, for the purpose of investigating the need for new cements and to draw up specifications covering them.

A great deal of confusion will exist in the minds of cement manufacturers and the public on the subject of these new cements until the report of this committee is made public, and until specifications covering a variety of cements for a variety of uses are definitely known and followed.

Portland cement will continue to be used for certain kinds of construction, and will, no doubt, be used as one of the essential ingredients in certain of the new cements. The remaining ingredients will be selected by the chemist and the manufacturer. The kinds, amounts, and the manner in which these materials will be incorporated, will depend upon the type of cement it is desired to produce.

Significant Names for New Cements

There will be a variety of new cements manufactured from a variety of materials. Those new cements which consist only in the mixing or grinding together of a number of cements, should be known as BLENDED CEMENTS.

Those new cements which consist in the mixing or grinding together of cement with slag, lime, clay, diatomite, and other kinds of calcareous, siliceous and argillaceous materials, should be known as MODIFIED CEMENTS.

Those new cements, such as those now being produced under the Blank patents,[3] whereby reactions are effected and compounds formed during the processing procedure, giving to the resulting products setting and strength as well as other definite and desired qualities and properties, should be known as PROCESSED CEMENTS.

It is of the utmost importance to both manufacturer and public that some distinction be made in the specifications to cover cements produced in different ways, for it is important that there be specifications to cover a cement for a given use. All of such points as these, which may primarily cause confusion, should be definitely taken care of at the earliest possible time, with a fairness to the producer and user.

---

[3] United States Patent No. 1,912,883 and Serial No. 644,083.

Wants State to Buy Plant

A PLAN to have the state of Wisconsin acquire control and operate the plant of the Manitowoc Portland Cement Company at Manitowoc, Wisconsin, bobbed up recently at a meeting of home owners in Manitowoc. Fred Koebke, former city official, made the proposal that the legislature be petitioned to enact legislation that would give the state its own cement plant.

President Thompson said that there might be some question of the right of the state to take steps to acquire a plant from a privately-owned company not engaged in the public utility business. He suggested that the whole matter be referred to the legislative committee of the league, which carried.

Safe and Health Practices Pamphlets and Index

A NEW list of the Safe and Health Practices pamphlets was inclosed with the February (1934) *News Letter* of the National Safety Council, 20 N. Wacker Drive, Chicago. This list is arranged alphabetically and will assist in checking subjects.

There is also available, for those who do not already have a copy, Safe Practices Index, recently printed and valuable in the use of your set of pamphlets.

Producing Clinkerless Slag Cements

Chemical Reactions Explained—Arrangement of Technologic Process for Production Operations—No Portland Cement Clinker Added

By PETER P. BUDNIKOFF
Professor, Laboratory of Ceramics, Chemistry Technological Institute, Charkoff, U.S.S.R.

CLINKERLESS slag cement is a product obtained from granulated basic blast-furnace slags or granulated basic slags with artificially increased calcium oxide content (added before granulation). These slags are subjected, in the dried state, to intimate grinding with mineral products which accelerate the hardening of the slag, these mineral products including calcined dolomite, anhydride, natural gypsum, etc. No portland cement clinker is added.

The proportion of basic blast-furnace slag in the finished product should be not less than 85 per cent, by weight.

Specifications for Clinkerless Slag Cement

Following are the specifications to be met by clinkerless slag cements:

(a) *Setting Time:* The initial set of the cement should occur in not less than 30 min., and the final set in not more than 12 hr. from the beginning of mixing. Experience with individual brands may justify a different time limit for the final set.

(b) *Volume Change:* The volume change must be at a uniform rate during tests in water and in the heat tests.

(c) *Fineness of Grinding:* The amount retained on a 900-mesh[1] sieve shall not exceed 2 per cent, by weight. The amount *passing* the 4,900-mesh sieve shall be not less than 85 per cent, by weight.

(d) *Tensile Strength* Neat cement and cement-sand mortar of slag cement and standard sand mixed in the proportion of 1:3, by weight, must have tensile strengths of not less than the following:

	Tensile Strength in Kg/cm^2	
Age	Neat Cement	1:3 Mortar
4 days	20 (285)	10 (142)
7 days	25 (356)	12 (171)
28 days	35 (498)	16 (228)

Note: Figures in parentheses are the corresponding values in lb. per sq. in.

(e) *Compressive Strength* Mortar with standard sand in the proportion of 1:3, by weight, must have compressive strengths of not less than the following:

Age	Compressive Strength in Kg/cm^2
4 days	70 (996)
7 days	100 (1,422)
28 days	160 (2,276)

Note: Figures in parentheses are the corresponding values in lb. per sq. in.

Process of Manufacture

Basic dry, semi-dry and water-granulated blast-furnace slags serve as the principal raw material for the manufacture of clinkerless slag cement. Slags suitable for the purpose should have a moisture content not exceeding 20 to 25 per cent if water-granulated, and not more than 1 per cent if dry-granulated. Water-granulated slag should not be coarser than 3 to 5 mm. (approximately ⅛ to 3/16 in.), while dry-granulated slag should not be coarser than 15 mm. (approximately ⅝ in.).

Chemical Composition of Slags

The chemical composition of slags suitable for the manufacture of clinkerless slag cement should be within the following limits:

The CaO content must be not less than 46 per cent.
The Al_2O_3 content must be not less than 9 per cent.
The MnO content must be not more than 3 per cent.
The Fe_2O_3 content must be not more than 2 per cent.

Slags must be of a gray, white, greenish or other light colors. The presence of black and dark brown grains and pig-iron particles renders the slag unsuitable.

The mineralogical composition of the slag must include not less than 90 per cent of vitreous substance, as determined from observation of thin sections under the microscope.

Slags of different chemical composition require different quantities of accelerators for hydration. The nature and quantity of these additions depend also on the method of granulation (whether dry, semi-dry or wet), and on the rapidity of granulation. For the best results, a rapid and intensive cooling of the molten slag is necessary. The period between leaving the blast furnace and the beginning of intensive cooling must be as short as possible.

Some Suitable Accelerators

For accelerators, different kinds of calcium sulphates may be used, such as natural gypsum, natural and artificial anhydride, and Estrich gypsum. Another accelerator may be dolomite, burned at 800 to 900 deg. C., or dolomite dust (refuse from the manufacture of metallurgical dolomite). These accelerators are introduced during the grinding of the slag.

With the view of taking advantage of the heat of the molten slag and changing its basic properties, the gypsum or natural anhydride may be introduced into the liquid slag, by means of special receivers, at the time the slag is flowing from the furnace to the granulator. In this case 2 per cent of chalk or gypsum may be added at the time of grinding, to regulate the setting of the cement.

Calcium sulphate (gypsum or anhydride), when introduced into the molten slag, partially decomposes and finally expels SO_2, thus:

---

[1] The 900-mesh sieve (900 openings per sq. cm.) is equivalent to 76 meshes per lin. in. The 4,900-mesh sieve is equivalent to 178 meshes per lin. in. Very roughly, then, the 900 mesh (metric) sieve corresponds to the 100-mesh sieve (American), while the 4,900-mesh (metric) corresponds roughly to the 200-mesh (American).—EDITOR.

$$2\,CaSO_4 = 2\,CaO + 2\,SO_3;\ 2\,SO_3 = 2\,SO_2 + O_2$$

The presence of silica combinations, ferric oxide and alumina causes a considerable reduction in temperature due to the $CaSO_4$ decomposition, thus:

$$CaSO_4 + SiO_2 = CaSiO_3 + SO_2 + O \text{ at 1,275 deg. C.}$$
$$CaSO_4 + Al_2O_3 = Ca(AlO_2)_2 + SO_2 + O \text{ at 1,360 deg. C.}$$

It may now be seen that the CaO, with metasilicate of calcium that was formed during the decomposition of the sulphate of calcium, forms the orthosilicate—

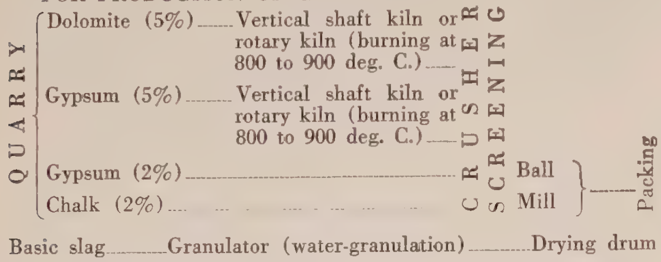
$$CaO + CaSiO_3 = Ca_2SiO_4$$

Assuming that the sulphide sulphur of the slag is locked up with calcium in the form of CaS, the chemical action which occurs when $CaSO_4$ is introduced into the molten slag can be seen in the equation—

$$CaS + 3\,CaSO_4 + 4\,CaSiO_3 = 4\,Ca_2SiO_4 + 4\,SO_2$$

Research has shown that sulphide sulphur in slags is not harmful to cement. On the contrary, it assists in improving the mechanical properties of cement.

TABLE 1—ARRANGEMENT OF TECHNOLOGIC PROCESS FOR PRODUCTION OF CLINKERLESS SLAG CEMENT


QUARRY
Dolomite (5%)
Vertical shaft kiln or rotary kiln (burning at 800 to 900 deg. C.)
Gypsum (5%)
Vertical shaft kiln or rotary kiln (burning at 800 to 900 deg. C.)
Gypsum (2%)
Chalk (2%)
CRUSHER
SCREENING
Ball Mill
Packing
Basic slag
Granulator (water-granulation)
Drying drum

Remarks: If the process involves dry or semi-dry granulation of slags, the drying drum is omitted. If gypsum is added at the crusher, it is not necessary to introduce chalk. The percentage of these added materials is approximate, the exact amount being dependent on the chemical composition of the slags, and the method of granulation.

Dry-Granulated Slags Preferred

In manufacturing clinkerless slag cement, slags of so-called dry granulation are preferable to water-granulated slags, other conditions being similar. This can be explained as due to the ready hydration of sulphide combinations during wet granulation, these combinations being subjected to oxidation with the oxygen from the air, and to the action of carbonic acid. As a result of these complicated chemical processes the sulphide combinations, after passing the state of hydrate formation, are transformed under the action of the carbonic acid of the air into neutral carbonic combinations. These latter combinations do not act on the vitreous substance as a stimulator. In consequence, the water-granulated slag does not receive the benefit of the increased chemical potential due to the stimulators, or accelerators, while the dry-granulated basic slag is so stimulated.

If we assume again that the sulphide sulphur of slags is present in the form of CaS, then the CaS will hydrate upon the addition of water. Thus—

$$2\,CaS + 2\,H_2O = Ca(SH)_2 + Ca(OH)_2$$

The newly formed sulpho-hydrate of calcium will oxidize by means of the oxygen in the air, making possible the following results:

$$Ca(SH)_2 + O = CaS_2 + H_2O$$
$$Ca(SH)_2 + 4O = CaS_2O_3 + H_2O$$
$$CaS_2 + 3O = CaS_2O_3$$

By further oxidation the polysulphurous calcium content will gradually decrease, and sulphuric CaS_2O_3 will increase. The latter then will be gradually transformed, first into the sulphate $CaSO_3$, and then into the suphate $CaSO_4$. Under the influence of water and carbonic acid of the air, the CaS will be transformed into sulphohydrate of calcium, $Ca(SH)_2$. Thus:

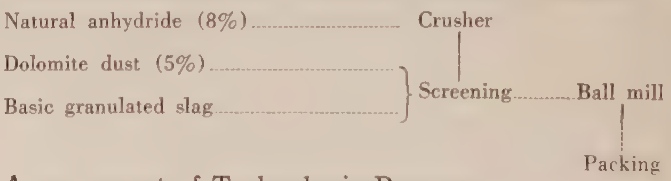
$$2\,CaS + CO_2 + H_2O = CaCO_3 + Ca(SH)_2$$

Subsequently, through the further influence of the CO_2 of the air, the sulphuretted hydrogen (hydrogen sulphide) will be expelled. This liberated H_2S has the familiar odor associated with hydrogen sulphide. The process just described is shown in the following formula:

$$Ca(SH)_2 + CO_2 + H_2O = CaCO_3 + 2\,H_2S$$

It is interesting to note that the addition of chalk to the slag cement not only solidifies the cement, but it also absorbs the sulphuretted hydrogen, thereby greatly diminishing the odor of the latter.

TABLE 2—SIMPLIFIED TECHNOLOGIC ARRANGEMENT



Arrangement of Technologic Process

The arrangement of the technologic process for the production of clinkerless slag cement is shown in Table 1.

In the event that dolomite dust and natural unburned anhydride are used to produce the burned dolomite and the artificial anhydride, the technologic arrangement for the manufacture of slag cement is considerably simplified. In this case the arrangement is as shown in Table 2.

Physical Properties

The maximum, minimum and average values obtained in tests to determine the physical properties of clinkerless slag cement are given in Table 3.

TABLE 3—PHYSICAL PROPERTIES OF CLINKERLESS SLAG CEMENT AS DETERMINED FROM TESTS

	Maximum	Minimum	Average
Specific gravity	3.00	2.89	2.91
Weight of 1 liter (61 cu. in.) in friable state	1,090 gr.	930 gr.	
Weight of 1 liter (61 cu. in.) in dense state	1,670 gr.	1,510 gr.	
Per cent retained on 900-mesh sieve (76 meshes to lin. in.)	2.1	0.0	0.3
Per cent retained on 4,900-mesh sieve (178 meshes to lin. in.)	12.2	2.6	8.5
Tensile strength of 1:3 mortar, in Kg/cm² (figures in parentheses are lb. per sq. in.—			
After 7 days in water	28.1 (400)	12.0 (171)	18.5 (263)
After 28 days in water	33.2 (472)	16.0 (228)	25.3 (360)
After 28 days storage	39.7 (565)	21.0 (299)	25.8 (367)
Crushing strength of 1:3 mortar, in Kg/cm² (figures in parentheses are lb. per sq. in)—			
After 7 days in water	342 (4,864)	120 (1,707)	190 (2,702)
After 28 days in water	359 (5,106)	180 (2,560)	200 (2,845)
After 28 days storage	342 (4,864)	193 (2,745)	280 (3,982)

Setting time usually varies, the initial set ranging from 30 min. to 4 hr. 20 min., and the final set ranging from 4 to 12 hr.

Regulations contained in the tentative instructions covering the use of clinkerless slag cement issued by the Building Institute of Charkow designate the following fields of use for this cement:

(1) Concrete blocks for walls.

(2) Combined lime-cement mortars for brickwork.

(3) Concrete foundation slabs and footings under walls, columns, and for machine bases.

(4) Concrete floors and concrete base for tile floors.

(5) Concrete base under asphaltic-concrete and block pavements.

(6) Concrete footings, pedestals, and other unreinforced parts of structures, which bear no more than moderately heavy loads.

Bibliography of Literature

Following is a bibliography of literature on the chemistry and production of "clinkerless" slag cement, which, as set forth in this article, is produced by the cooling of molten slag and the addition of certain activators at various stages of the process, but without the addition of portland cement clinker.

Literature: P. P. Budnikoff—On researches of gypsum. Publ. Acad. Science 1930 and 1933. Dto.—Slag-cements "Stroitelnije Materiali" Nr. 2 p. 18, 1930. Dto.—The perspective of Donbass for the 2nd 5-year period. Vol. II, Charkow, 1931. Dto.—Reports of the All-Union Conference for standardization and manufacture of new building materials, Moscow 1932. P. P. Budnikoff and W. M. Lejoew—"Clinkerless slag-cement," Stroitelnije Materiali Nr. 10, P. 19, 1930. Dto.—Basic blast furnace slags and their use for manufacture of clinkerless cement—Jour. of Applied Chem. Vol. III, Nr. 5, P. 669, 1930. P. P. Budnikoff and L. G. Gulinowa—Dolomite, burned at various temperatures and other substances, that serve as activators for granulated blast furnace slags. Jour. of Applied Chem. Vol. IV, Nr. 4, 1931, p. 447. Dto.—Various modifications of sulphate of calcium, as stimulators for basic blast furnace slags. Jour. of Applied Chem., Vol. V Nr. 3-4, 1932, p. 305. P. P. Budnikoff—British patent Nr. 347,357, 1931. Magazine—"New slag-cements" Is. 9, issued by the State Scientific Research Inst. for Concretes. Report of the committee on new cements in the Ukrain,. Building Inst. Leningrad 1931. P. P. Budnikoff and D. Culinow—New cements from blast furnace slags—Tonind. Ztg. Nr. 35, 1933 p. 402. P. P. Budnikoff. Klinkerloser Schlackenzement, Zement, No. 24, 1933, p. 325-330, Nr. 25, p. 342-344, Nr. 26, p. 359-361.

Express Doubt That Federal Government Will Build Cement Plants

No Profit at Present "High" Prices, Manufacturers Point Out—Need Higher Production Volume Before Price Can Come Down

(From *Chicago Journal of Commerce*, February 8. 1934)

CEMENT manufacturers in this district, commenting on the statement of Secretary of the Treasury Ickes that the present "high cost" of cement may drive the federal government into the industry, express the opinion that after the government had looked thoroughly into the matter it would decide against building mills in the Tennessee Valley or elsewhere.

Secretary Ickes, who is also administrator of public works, said complaints from the government and private industry on existing prices had been turned over to the federal trade commission.

He declared public works projects had been retarded, due to the present price level of the material.

No Profit at Present Rates

The existing price of cement does not allow of profitable operation on the present volume of business, producers here state.

Commenting on the proposition of the government's producing its own cement, which Mr. Ickes said he would favor, local manufacturers found it difficult to reconcile this with the industry NRA code provision which prohibits establishment of new mills.

They disagreed with the secretary that the code could be imposed on private companies and at the same time allow the government to construct new plants.

"This latest declaration is out of step with the administration and the NRA," one of the producers here declared. "Wages have been raised under the code and are now back to the 1929 level. Prices we receive for our product, however, are considerably under five years ago."

Costs Vary with Volume

He pointed out that costs vary sharply with volume of production and that output today is only one-half what it was in 1929, while wages are about the same and selling price less.

He said that if volume could be obtained, operations could be carried on satisfactorily around present prices. Regarding possible operations of a government plant he said:

"If the government could operate a plant at 100 per cent of capacity and did not consider interest charges, depreciation and taxes it could probably make cement at lower prices than those now in effect. However, it would have to be used close to the place it was made, for it is unprofitable to ship the material more than 200 or 250 miles, due to existing high freight rates."

Another official in the industry declared that many companies can not operate at the present level of production costs and selling prices and find it less costly to close plants rather than to produce at 18 or 20 per cent of capacity.

"If the mills could lower the price and keep operating they would do so rather than shut down," he said. "There are several mills in the territory in question that are closed."

✦ EDITORIAL ✦

A Process Engineering Industry

MANY professions and trades are represented directly or indirectly in the cement industry. Just to mention a few, the mechanical engineer designs mill equipment and power plants; the knowledge of the electrical engineer is required in connection with generators, transformers, motors, and transmission lines; and much of the cement is used for projects under the direction of the civil engineer. The industry has reached its present technical status as a result of absorbing developments in these and other professional fields.

The cement industry is one of a group of chemical engineering or process engineering industries. Raw materials must pass through chemical changes to become transformed into the finished product. In fact, every step in the manufacturing process involves chemical changes or is in preparation for chemical changes. Process engineering is made up of a series of unit processes. All of these are found in the industry, and conversely there is no step in the industry which does not coincide with one or more of the unit processes.

From this it is apparent that the cement manufacturer and user should by no means overlook the important practical information available in the chemical engineering field. Contrary to an erroneous impression more or less prevalent in the industry, such information is by no means confined to the laboratory, but is applicable to many phases of research, design, construction, and operation.

"Concrete" is fully alive to the situation. In recent issues several editorials and articles have brought the matter to the attention of readers. Also, from now on, announcements of chemical engineering events will appear in the calendar of meetings. Increased support of societies, clubs, and other organizations in the chemical engineering field would be an excellent investment for the cement manufacturing industry.

Increasing Demand for New Types of Cement

ARTICLE XIII of the Code of Fair Competition for the Cement Industry provides that manufacturers may sell cement produced under modified specifications designed to meet special or unusual conditions not adequately covered by the so-called standard portland cements.

Among such "special or unusual conditions" a case in point is that of concrete subjected to the action of sea water. In this instance the danger, so far as chemical action is concerned, is believed to rest mainly with the sulphates and other salts carried in solution in the sea water.

Another special condition arises wherever concrete is placed in large masses, as in large gravity dams. Here the dangerous factor is the heat generated during hardening, first causing expansion of the concrete, followed by shrinkage as the mass cools, the shrinking being accompanied by undue cracking.

In still other instances the conditions may require a rapid-hardening cement, or greater plasticity, or resistance to alkali waters, or resistance to extreme variations in temperature.

While the thought of several new types of cement may not be pleasant to contemplate, from the manufacturer's point of view, the fact remains that a constantly increasing number of cement users will demand them. The industry can not continue forever ascribing disintegration of concrete to improper proportioning or faulty placing methods.

The solution of these problems, if the cement user's requirements are to be met, must be reached through chemical combinations and burning processes and related means. A few companies, in fact, are meeting the difficulty in just this way.

The Trend Turns Upward

SHIPMENTS of portland cement in November were slightly under the figures for November, 1932. Shipments in December were 31.8 per cent above those of December, 1932.

Then, keeping up the December turn in the trend, January shipments were 51.0 per cent above January of last year! The month of January also reversed a normal seasonal trend by showing shipments slightly in excess of the previous month.

Here is something new for the cement industry—a record of monthly shipments in excess of shipments for the corresponding month of the year before. Not since May, 1930, has the industry experienced that thrill. In the long parade of 42 months following that date, until the tide was turned in December, 1933, the record was one of continued discouragement, each successive month reporting shipments below the corresponding month of the previous year.

Ordinarily, a favorable showing in two successive months could not be regarded as having established a trend; but the high percentages of increase in December and January are too significant to be ignored.

The construction program of the federal government, now beginning to be reflected in cement shipments, constitutes in itself a promise of large requirements. But this is not the only hope of the construction industry, for privately financed construction has also shown a definite pick-up, surprising as it may seem.

There is a sound basis for the belief that 1933, with 64,086,000 barrels shipped, marked the bottom of the trough for the cement industry.

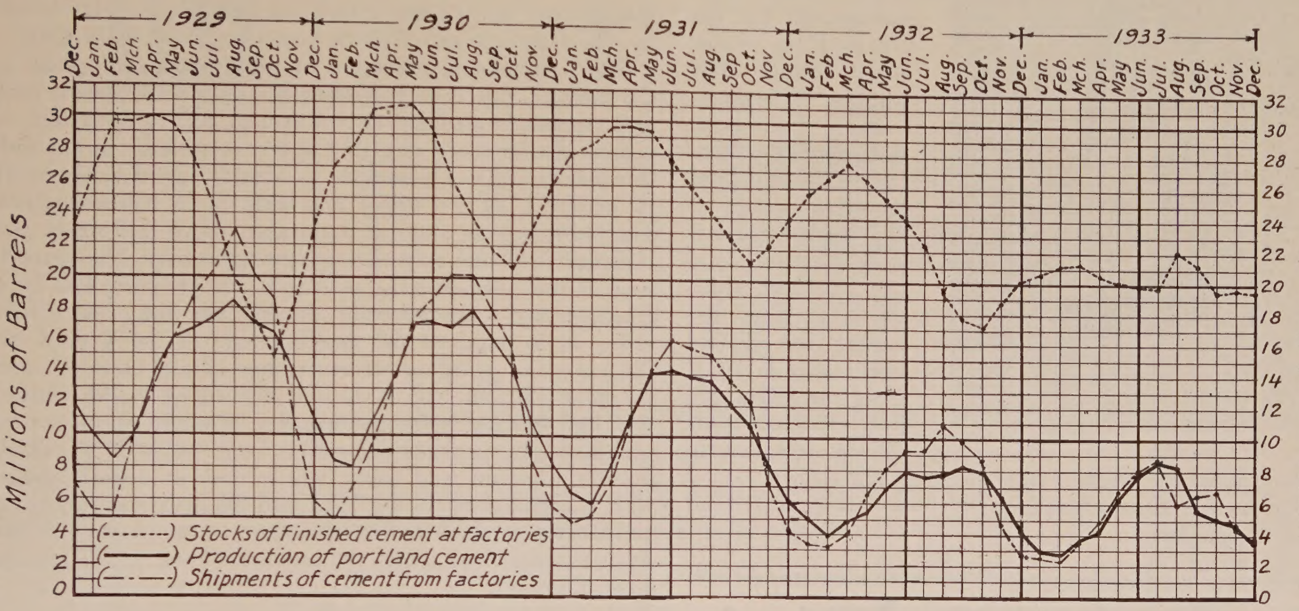
Cement Statistics for December

Relation of Production to Capacity (Per Cent)

	The Month	Twelve Months
December, 1933	15.5	23.6
December, 1932	18.5	28.3
November, 1933	21.2	23.9
October, 1933	22.1	24.5
September, 1933	25.5	25.5

Production, Shipments and Stocks of Finished Portland Cement (Barrels)

	1932	1933
Production, December	4,248,000	3,526,000
Shipments, December	2,835,000	3,738,000
Stocks at end of month	20,240,000	19,498,000
Production for year to date	76,509,000	63,373,000
Shipments for year to date	80,579,000	64,086,000



Cement Production and Shipments Gain in January

PRODUCTION of portland cement in January, this year, showed an increase of 27.8 per cent and shipments an increase of 51.0 per cent, as compared with January, 1933. Portland cement stocks at mills were 5.3 per cent lower than a year ago.

The industry produced 3,779,000 bbls. in January, 1934; shipped 3,778,000 bbls. from the mills, and had in stock at the end of the month 19,541,000 bbls.

The factory value of shipments from the mills in 1933—64,086,000 bbls.—is estimated as $83,965,000.

These figures are from the Monthly Cement Statement from the United States Bureau of Mines.

Puzzolanic Cements Improved by Calcium Chloride

THE rather slow setting time of mortars and concretes made with puzzolanic cements can be improved by the addition of calcium chloride.

With a view toward determining the optimum quantity for general use, F. Ferrari made a series of tests described by him in *Cemento Armato*, No. 30, 1933, pages 53-55. Mixes of standard neat cement, mortar and concrete, with and without the addition of calcium chloride, were prepared.

The tests were conducted in two series, (1) by adding 1.3 and 1.1 per cent (by weight of cement) of calcium chloride at the time of mixing the batch; and (2) by adding like quantities at the moment of grinding the cement.

The constitution and fineness of the cements used, and curing conditions of the test pieces, are stated, and the results of tests at ages of 3, 7 and 28 days, 6 months, 1 year and 2 years are tabulated, in the original paper. The author concludes that the results show that an improvement in both setting time and strength is obtained by the addition of calcium chloride.—*Building Science Abstracts* (London), November, 1933.

Another 1000-Day, No-Accident Record

Believing that the first thousand days of safety are the hardest, workers at the Universal, Pennsylvania, plant of the Universal Atlas Cement Company are now laying plans to extend their safety record to the 2,000-day mark. Completion of 1,000 days without a lost-time accident on January 31, made the plant, which is located near Pittsburgh, eligible for membership in the 1,000-day club of the Portland Cement Association.

Safety work at the Universal plant is under the supervision of Mr. Slocum and J. R. Cline, assistant superintendent, who heads the safety committee.

◆ PERSONAL ◆

Harry L. Block, 70, president of the Missouri Portland Cement Company, died February 6 of heart disease at his home in Clayton.

MILL EQUIPMENT

A NEW rock grab, specially adapted to handle rock or cut-stone has recently been announced by Bucyrus-Erie Company, South Milwaukee, Wisconsin.

With this grab, Bucyrus-Erie claims rock may be tipped or rolled, picked up and laid down exactly in place without resetting, shifting or jacking. Releasing the closing line immediately frees the lifted object. Rubber pads can be supplied to permit handing polished stone without marring.

The rock grab is offered in four sizes—2½, 5, 10 and 20-ton capacity.

Manufacturers' News

INGERSOLL-RAND Company announces they have acquired the turbo-blower business of the General Electric Company and will consolidate it with their own turbo-blower department.

The complete line of blowers now offered by Ingersoll-Rand includes low pressure units for aeration of sewage, ventilating and air conditioning systems, blowing cupolas, atomizing oil for furnaces, furnishing agitation air for flotation work, and for raw water ice systems, operation of pneumatic conveying systems, and developing pressures and vacuums in handling manufactured gas.

●

A SIMPLE set of instructions on blasting has been formulated by explosive experts of E. I. du Pont de Nemours & Co., Wilmington, Del., following requests for knowledge on the types and uses of explosives required for PWA activities. Thousands of men who are unfamiliar with the uses of explosives will be employed on road building and other public works, and these instructions will enable new users to inform themselves as to the exact types of explosives for different applications, and their efficient and economical uses.

●

ALLIS-CHALMERS Manufacturing Company, Milwaukee, announces the removal of its Buffalo district office to the Liberty Bank Building on February 24. A. R. Brown is district manager in charge.

●

A. G. Pratt, president of the Babcock & Wilcox Company, has been elected to the Board of Directors of the Worthington Pump and Machinery Corporation.

Industrial Literature

"THE Ball-Bearing Principle of Grinding" (by R. M. Hardgrove) is the title of Bulletin F-907A, recently issued by The Babcock and Wilcox Company, New York City.

The ball-bearing principle of pulverizing, according to the booklet, has been successfully applied to cement rock and clinker in a closed-circuit system with a minimum of power, maintenance cost and space occupied. In the ball thrust-bearing, is a principle as ideally suited to the work of grinding as the wheel and axle is to transportation. The balls, having a spiral path, wear down uniformly and continue to fit the race throughout their life. The correctness of the "ball-bearing principle" of grinding has been demonstrated commercially during the last four years only, as it required the development of the proper arrangement of grinding elements, flow of air, material, and the most efficient ball pressures, according to the author. The ball-bearing principle has the inherent characteristic of producing an exceptionally large amount of small micron material and, even when used in closed circuit with a high recirculating load and efficient scavenging, it produces a product that is equivalent to the product of the open-circuit tube-mill in the amount of the small micron sizes, they say.

●

"HARD-FACING with Haynes Stellite Products" is the title of a 96-page booklet recently issued by the Haynes Stellite Company, Kokomo, Indiana. A detailed description is given of various hard-facing materials and the correct procedure for their application by both the oxy-acetylene and the electric arc processes.

A metal surface, which due to its use is normally worn away rapidly, is protected by a layer of special alloy which possesses exceptional resistance to abrasion.

●

FULLER-KINYON pump, Type "F," is said to be the ideal conveyor for short and average cement plant conveying distances, because of low air pressure operation and surprisingly low total power consumption. The makers, the Fuller Company, Catasauqua, Pa., recommend it as an inexpensive replacement for obsolete or worn mechanical systems and as being well adapted for loading bulk cement into cars and barges.

●

A NEW 64-page illustrated catalog and engineering data book (No. 1240) has recently been completed by Link-Belt Company, Chicago, on equipment for the mechanical handling, screening, sizing, washing, dewatering and preparation of sand, gravel, stone and other non-metallic minerals. Several new products are included in the book.

●

"TWO Coats with One Stroke of the Brush" is the title of a new piece of literature being distributed by the Quigley Company, Inc., New York City. In one application, they say, Triple-A No. 44 Aluminum primes, protects and decorates the surface on which it is applied.